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CONGENITAL ATRESIA OF THE NASAL CHOANAE.*†

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Congenital choanal atresia, when bilateral in the newborn, may cause death from asphyxia soon after birth. If the infant survives the first few days, it may fail to gain weight, become emaciated and finally die of starvation. In the past this developmental anomaly, no doubt, has been mistaken for axphyxia neonatorum; and even at the present time, the true nature of this condition may be confused with other causes of asphyxia. Prompt diagnosis and adequate therapeutic measures may be necessary to save life.

BRIEF HISTORICAL REVIEW.

Choanal atresia, although uncommon, has provided the theme for many scientific papers ever since the publication of the first case report by Emmert in 1853.[1] He successfully operated on a seven-year-old boy with bilateral atresia, who, in infancy had difficulty taking nourishment, and had attacks of suffocation during his sleep.

Reference to atresia of the posterior nares had previously been made by Otto. In 1814 he wrote, "From time to time the posterior openings of the nose are missing, as a congenital abnormality,"[2a] and in 1829 he wrote, "In congenital closure

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of the hinder openings of the nostrils, the palatine bones are very much deformed."[2b] The first statement apparently was based on a publication by Roerderer. Although Otto did not report a case, these statements indicate that the condition was recognized at that time. Reference has also been made to a later publication by Otto.[2c] In this treatise he described a human monster, having only one nostril without a choana (Case 101) and two swine monsters, one with no nose at all (Case 106), and one with closed depressions where the choanae should be (Case 554). While Cases 101 and 554 are of some historical interest, Case 106 should not be included.

Von Lushka,[3] was the first to give a detailed description of the occluding structure. His case was that of a girl who died shortly after birth. He stated that the bony framework was a continuation upward and backward of the posterior, normally free border of the horizontal part of the palate bones.

The first case reported in this country was by Cohen[4] in 1879. He successfully operated on an infant with bilateral choanal closure.

Ronaldson[5] in 1881 reported the first British case. He recognized the pathological process but not the seriousness of the condition and chose to defer treatment. Unfortunately, the child died within an hour after his departure.

In 1886, 33 years after the first case report, Hubbell[6] reviewed the literature and listed 16 cases, to which he added one. Following this presentation there was a gradual increase in the number of cases reported. By 1903 the total number was said to be 61,[7] and by 1910 it was estimated to be 115.[8] According to Durward and associates,[9] whose review of the literature included 347 authors, some 390 authentic cases had been reported by 1945.

INCIDENCE.

In 1914, Richardson[10] commented that seldom was a rhinologist fortunate enough to see more than one case of this

type of malformation, and that many with wide experience had never seen a single case.

The number of cases observed at the Mayo Clinic,[11] between 1907 and 1939 was only 12. Four of these were bilateral; five were right-sided, and three were left-sided.

In the Massachusetts Eye and Ear Infirmary,[12] between 1922 and 1938, ten patients were found to have choanal atresia. Three were bilateral, four were right-sided and three were left-sided.

Among 27,863 patients examined in the Ear, Nose, and Throat Department of the Royal Infirmary of Edinburgh, in a 20-year period (1907-1926, inclusive), there were six cases of unilateral atresia and no cases of bilateral atresia.[13]

A hereditary tendency has been suggested in a few instances where two or more members of the same family had congenital choanal atresia.[13-20] In one of these families,[14] six members were affected.

Of the 292 case reports reviewed by Durward and associates,[9] 65 per cent were females and 30 per cent were males. The sex was not stated in the remaining 5 per cent of cases.

While congenital choanal atresia is now being recognized more frequently than it was 50 years ago, most writers on the subject have been able to report no more than two or three cases. Exceptions, of course, have been noted: Medovy and Bechman,[21] reported five cases. Owens[22a] reported seven cases, and has since operated on an additional 10 cases.[22b] McGovern's reports included 11 cases.[23] Ersner observed 14 cases.[57]

Richardson,[10] White,[24] Colver[25] and others have suggested that many undiagnosed cases of bilateral choanal atresia have undoubtedly died from asphyxia soon after birth. It is interesting to note, however, that Potter,[26] in her book on "Pathology of the Fetus and Newborn," describes many malformations of the head, including atresia of the nares, but fails to mention choanal atresia. She does, however, advise that in performing postmortem examinations, patency of

the nostrils should be tested. This suggests that choanal atresia is being recognized, but is not a common cause of neonatal death.

DEVELOPMENT.

Embryology.

The olfactory organ, in 35-day embryos, is represented by two epithelial pouches lying in the mesenchymal tissue just above the oral cavity. The dorsal extension of these primi-

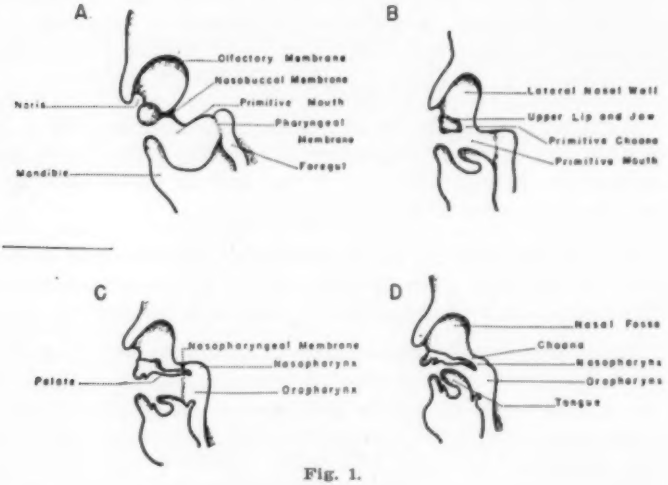

Fig. 1.

tive nasal fossae meets the ectoderm of the oral cavity forming the bucconasal membranes (see Fig. 1-A). By the thirty-eighth day of embryonic life the bucconasal membranes rupture, forming the primitive choanae, which are located anteriorly in the roof of the mouth[27a] (see Figs. 1-B and 2-A).

Soon after the formation of the primitive choanae, the definitive palate begins to develop as ridges on the medial aspect of the maxillary processes. These palatal processes grow medially, and eventually meet in the midline. In the

formation of the definitive hard palate, a portion of the primitive buccal cavity is isolated and made part of the nasal cavity.[27a]

While the palate is forming, the nasal septum grows dorsally toward the pharynx and caudally into the buccal cavity, and the nasal fossae are elongated.[27a]

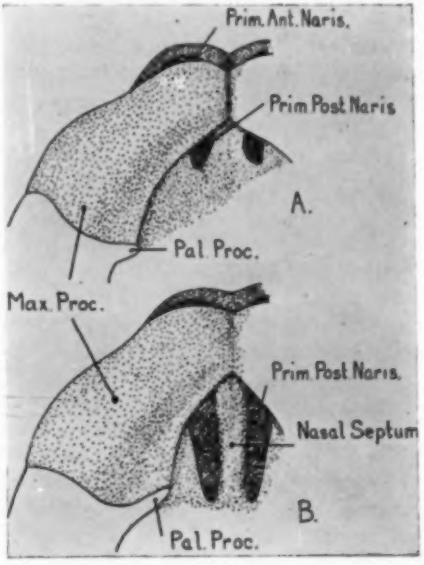

Fig. 2.

Coincident with the formation of the palate and the growth of the nasal septum, the primitive choanae become elongated and form slit-like passageways between the nasal and buccal cavities (see Fig. 2-B). The continued growth and ultimate fusion of the palatal processes with the nasal septum, force the primary choanae to undergo a steady migration until communication with the pharynx is established (see Fig. 1-D). This connection locates the definitive choanae.[27a]

Theories of Causation.

1. Should the primitive choanae fail to form, the continued dorsal growth of the nasal fossae would ultimately lead to a condition in which the epithelium of the nasal fossae would come in contact with the epithelium of the nasopharynx with a variable amount of mesenchymal tissue between the epithelial surfaces. This would result in atresia of the choanae, and if the mesenchyme should remain thick, an osseous atresia would be formed.[27b]

In those cases where cartilage appears in the atresic wall,[13,28,58] there has been an objection to this theory on the assumption that bone developing in the bucconasal membrane must be membrane bone.[13,29,30] This assumption erroneously implies that the bucconasal membrane is part of the membranous cranium, the embryologic structure from which all membrane bones develop.[31] Since the structure occluding the choana is an abnormal structure, it is reasonable to assume that its condensed mesenchymal tissue may either become part of the membranous cranium or part of the chondrocranium. If this assumption be correct, the occluding structure could contain either membrane bone or bone formed in cartilage.

2. Keith[32] and Schaeffer[27a] have observed one or both primitive nasal fossae to be closed by a plug of epithelium (see Fig. 3). They stated that the epithelial plug sometimes organizes and forms membrane, or bone, and gives rise to atresia of the posterior nares.

3. Durward and associates suggested that the most likely cause of choanal atresia is a failure of full development of the primitive posterior nares—a failure at the posterior end. They stated that this is consistent with full palatal development and with the variations in structure and position of the atresic wall.[9]

4. Another theory advanced by Richardson,[10] and later by Stewart[13] and Colver[25] is that failure of the upper portion of the pharyngeal membrane (buccopharyngeal membrane) to be absorbed, accounts for those atresias lying posterior to,

and against the choanae (see Fig. 1). One of Stewart's cases, in addition to a bony atresia lying within the choanae, also had a membranous atresia just posterior to the choanae.

5. Embryological activity resulting in an over-production of tissue in the region of the choanae is another theory mentioned by Richardson.[10] An overgrowth or deformity of the vomer,[14,33-35] the palate bone,[3,36,37] the body of the sphenoid,[38] and the internal pterygoid plate[34,35] has been suggested as a possible cause of the obstruction.

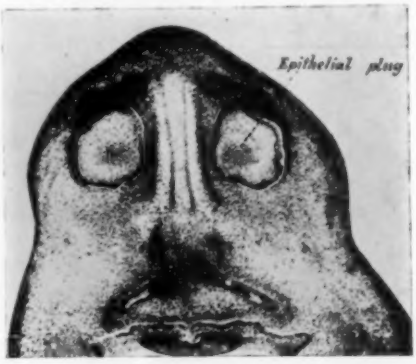

Fig. 3.

Coakley's[38] suggestion that the bony occlusion in many cases is an outgrowth from the body of the sphenoid is interesting, since the body of the sphenoid is the only bone ossifying in cartilage that forms a portion of the choanal boundary.[31] This could account for the islands of cartilage found in some bony atresias.

In Robert's[33] case (an adult), the bony framework was fused to the posterior portion of the vomer, and appeared to be a part of that bone. The vomer, a membrane bone, develops in two plates, one on each side of the cartilaginous septum. They later unite from behind forward at the expense of the imprisoned cartilage, and completely fuse by the fifteenth year of life. Rarely they retain a bit of carti-

lage which may form a chondroma.[27a] An outgrowth from the vomer, therefore, is also consistent with a bony atresia containing cartilage.

An attempt has been made to explain the presence of cartilage in the partition, on the basis of an overgrowth of the palate bone.[13,29,30] Since the palate bone is a membrane bone,[31] this explanation can no longer be accepted.

Fig. 4.

THE ATRESIC STRUCTURE.

The atresic structure consists of a partition inclined upward and backward (see Fig. 4). It is attached, superiorly to the under surface of the body of the sphenoid, laterally to the internal lamina of the pterygoid process of the sphenoid, medially to the vomer and inferiorly to the horizontal part of the palate bone. It may lie at the choanal margin, or at a point 1 to 3 mm. anterior to the posterior edge of the vomer.

The occluding structure may be membranous, osseus, or membrano-osseus. It has been estimated that in 80 to 90 per cent of the cases, the partitions are bony or membrano-osseus.[9,39] Cartilage may also be present.[13,28,57] Each sur-

face is covered with mucous membrane derived from the adjacent mucosa. The partition may vary in thickness from a mere membrane to 12 mm.[9,26,40] It may be of uniform thickness, or one portion may be thinner than the remainder.[36,41,42] The central portion is usually thinner than the periphery and sometimes may be composed of membrane only. In these cases, examination with the postnasal mirror generally shows a dimpling at this point, and occasionally a perforation. This opening, when present, is functionally of no value, for it gives the patient neither the ability to blow the nose nor to breathe.[39] A loose application of the term "atresia" (imperforation) permits the inclusion of obstructions with minute perforations under this title.[13]

ASSOCIATED MALFORMATIONS AND DISEASES.

McGovern[23a] analyzed 47 cases reported by 25 observers and concluded that the development of the sinuses is not impaired and that sinusitis is an occasional rather than a routine finding.

He further observed that in all but ten of the 47 cases the hearing was normal, and that chronic suppurative otitis media was recorded in only six cases.

Ten of the 47 cases showed high arching of the palate, five cases showed asymmetry of the face and six cases showed one of the following: Bifid uvula, congenital colobroma of the iris, double tragus on each side, double congenital aural fistula, polydactylism, or flat nose with separation of the cartilages at the tip.

McGovern,[23b] in a later report, presented two cases with associated congenital heart disease.

Owens[22] observed the nasal passages on the occluded side to be narrow, especially posteriorly, in all 17 of his cases, and the palatal arch was higher on the obstructed side in all but one of his cases. He concluded that the atresic wall was responsible for this malformation and advised early surgical cure to allow full development of the nasal passages.

Baron's[43] case, an infant with bilateral choanal atresia, de-

veloped left-sided internal strabismus when three years of age.

Beinfield[44] reported a case of bilateral atresia that also had congenital coloboma of both lower lids, congenital aplasia of the punctum and canaliculus of both lower lids, paralysis of the right iris and atresia of the right external auditory canal.

Weller operated on a patient who also had duplication of the upper urinary tract (pelvis and ureter) on the right side.[45]

SYMPTOMS.

Patients with choanal atresia fall into two main clinical groups—those with bilateral obstruction and those with unilateral obstruction.

Bilateral Atresia.

The bilateral group may be further divided into four subgroups:

1. Infants with cyclic dyspnea, the symptoms of which are severe; *2.* infants who have dyspnea while suckling; *3.* infants who have no dyspnea; and *4.* older patients.

1. Cyclic Dyspnea. The newborn infants in this group do not acquire the mechanism of mouth breathing until several days after birth. Because of this inability to breathe through the mouth they have severe asphyxia and may die. Ronaldson's[5] description of a female infant, born at full term, may be considered classic for this group. He stated, "When the child was born, I at once noticed that there was some peculiar obstruction to its breathing. On attempting to inspire, the lungs were not inflated, while the under lip and cheeks were sucked in. In slapping the buttocks to make the child cry, there was no difficulty to free respiration when the mouth was opened. In keeping the mouth open by a spoon and pulling the tongue a little forward, it breathed well and steadily, and cried lustily. I observed that whenever it reached a point of moderate asphyxia it opened its mouth to cry, and thereby had an opportunity of inflating its lungs through the open mouth."

Richardson's[10] description emphasized more fully the recurring phases of asphyxia followed by quietude. He stated, "There is a constant repetition of this cycle, unless constant relief through mouth breathing is brought about." The struggle for breath is so great that it is impossible for the infant to nurse, which makes nourishing it a serious problem. Lebensohn[29] and later Colver[25] gave Richardson credit for applying the term "cyclic dyspnea" to this syndrome, although he never actually used the term in his writings. Mouth breathing is usually learned during the second week of life (after the eighth day for Phelps' case[14] and the fourteenth day for Richardson's case[46]). Durward and associates[9] differentiated this group from those who have no asphyxia at birth, but do have asphyxia while suckling.

2. Dyspnea While Suckling. In this group symptoms of suffocation occur whenever suckling is attempted. These patients usually snore and breathe heavily, and may also have attacks of suffocation during sleep. If untreated they may become emaciated and eventually die of starvation. These infants usually learn to manipulate the bottle within three weeks, alternating in sucking and breathing through the mouth.[10,46]

3. Infants with No Dyspnea. It is exceptional for infants to belong to this group.[9] Wright[20] reported two cases, who had neither asphyxia at birth nor any difficulty in suckling. Their breathing was very noisy for a period of two years, after which it became quiet. One of Stewart's[13] cases fed at the breast and was not difficult to rear.

4. Older Patients. Patients who survive to early childhood or adult life without surgical treatment present the signs and symptoms of complete nasal obstruction. History may reveal that in infancy they had difficulty in breathing, difficulty in feeding and were unable to gain weight. They are mouth breathers, and there is absence of nasal quality to the voice. Articulation may be difficult.[41] Since there is no way to relieve the pressure produced in the nasopharynx and ears during the act of swallowing, some will complain of an unpleasant sensation in the ears when eating. Anyone may

simulate this experience by holding the nose closed while swallowing.[25] Colver's case,[47] a girl two years and eight months of age, ate only soft foods because she could not chew without breathing. The sense of smell is impaired, even to anosmia, and the sense of taste is altered. There is an excessive nasal discharge, and some patients find the frequent wiping to be almost incapacitating; others are bothered only by profuse discharge on bending forward. Because of inability of the tears to pass into the pharynx, they also flow from the anterior nares when crying. Inability to blow the nose is a common complaint. Excoriation of the upper lip and nasal vestibules, caused by constant passage of secretion, is a source of irritation to some. Dryness of the mouth and throat, caused by mouth breathing, may be very annoying.[9] Occasionally there is no complaint. Hart[48] reported a case of bilateral obstruction in a 21-year-old woman who presented herself for an eye examination. She was a mouth breather, and examination showed some mucus in both nostrils, but the obstruction apparently gave her very little discomfort. She refused surgery.

Unilateral Atresia.

In unilateral atresia, the infant may, at times, experience difficulty in nursing if the patent nostril becomes blocked. The mother may notice that the child can nurse only while lying on the obstructed side so that the patent nostril is above and not blocked by venous congestion caused by gravity. In nursing at the breast with the patent side against the mother, difficulty will be experienced.[9]

Most of these cases have no symptoms until they are old enough to observe that they are unable to breathe through one nostril. Complaints, such as excessive nasal discharge, inability to blow the nose, excoriation of the upper lip and anterior naris, may be almost as distressing as they are in the bilateral cases. Some find these symptoms no more than a nuisance and may refuse surgical treatment.[9,13,23,26,48] Thomasson[49] reported a case of a 29-year-old man with unilateral atresia who had noticed that he was unable to clear the right nostril by blowing the nose, but had never discovered that he was unable to breathe through it.

DIAGNOSIS.

The recognition of choanal atresia is not difficult, providing the examining physician is aware of this developmental anomaly. Whenever an infant has difficulty in breathing and is unable to nurse, choanal atresia should be suspected. Improved breathing after the insertion of an oral airway confirms upper respiratory obstruction.

Inability to pass a small catheter through the nostrils into the pharynx, even after shrinkage, is strong evidence that the choana is obstructed. Gentle palpation with a cotton tipped applicator, or silver probe, which has been passed through the anterior naris along the floor of the nasal fossa will localize the obstruction and give a clue as to its character. The hard, firm resistance of bone is readily differentiated from the soft resistance of membrane.[5,9,10] In order to prevent the confusion that may result from palpating the posterior wall of the nasopharynx, a catheter may be passed through the nostril and observed in the oropharynx.

The diagnosis may be confirmed by the instillation of iodized oil followed by roentgenograms. This may also give some idea as to the thickness of the obstruction.

Roth and Geiger[51] filled the nostrils with water and noted that the fluid remained in the nose and did not appear in the pharynx. Ronaldson[5] Phelps[14] and Colver[25] attempted to blow air through the nostrils with a Politzer bag or rubber bulb syringe.

Baron[43] described ballooning of the soft palate as a diagnostic sign of bilateral choanal atresia. If the anterior part of the tongue is depressed just enough to bring the soft palate into view, but not enough to produce an oral airway, the soft palate balloons out when the infant attempts expiration.

It has been stated that posterior rhinoscopy could be performed in infants by passing the nasopharyngoscope through the mouth into the nasopharynx.[14,52] I was unable to see the choanae by this method.

In older patients, after thorough shrinkage of the nasal

membranes and removal of the accumulated mucus, the obstruction may be seen by anterior rhinoscopy. A deflected nasal septum, of course, might render this examination ineffectual. Posterior rhinoscopy is an important procedure, and may be the only means of distinguishing between choanal atresia and a large postnasal ploypor foreign body. Where this examination is impossible because of uncontrolled gag or lack of cooperation, local or general anesthesia and retraction of the palate may be necessary.

There should be no difficulty in differentiating choanal atresia from hypertrophied adenoids, nasal polypi, neoplasms, foreign bodies, or deflection of the nasal septum. Wright[20] suggested that the existence of a complete obstruction of the airway on one or both sides of the nose in an infant is never due to adenoids. A number of cases have gone undiagnosed for years, having undergone such surgical procedures as adenoidectomy (in some cases as many as three times), adenotonsillectomy, nasal polypectomy, excision of a portion of a turbinate and submucous resection of the nasal septum.[13,20,28,39,53] The second case herein reported had undergone a submucous resection of the nasal septum but choanal atresia remained undiagnosed. Severe stenosis of the nasal passages may be difficult to differentiate from an incomplete atresia. In either case the patient may be able to force a little air through the nostrils, just enough to cause the accumulated mucus to form into bubbles at the nares, but not enough for respiration.

TREATMENT.

In treating patients with choanal atresia, one must be guided by the seriousness of the symptoms observed in each individual case.

Infants with bilateral choanal atresia, who are unable to breathe through the mouth, must be provided with an adequate oral airway until mouth breathing has been established, or until surgical cure has been accomplished. Constant attendance is necessary, because failure to maintain the oral airway, even for a short time, might prove fatal.

Because of inability to breathe through the nose while nursing, nearly all of these infants must be fed by medicine dropper, spoon, or stomach tube, until they learn to nurse. Hanckel performed a tracheotomy on an infant of one month, to relieve the dyspnea at feedings, and allow it to gain weight and strength to withstand surgical treatment.[20]

Unilateral atresia is likely to escape notice until later in life. Bilateral atresia in older children and adults never produces serious symptoms, and its surgical cure may be performed when convenient.

Surgical Treatment.

The technique of the surgical procedure to be used in a given case must vary somewhat with the age of the patient, the type of occluding structure and the condition of the nasal septum. There are two approaches to the radical cure of this condition: *1.* Intranasal, and *2.* transpalatine.

Intranasal Approach.

In adults, whose nasal passages are large enough for good exposure, the intranasal approach may be tried. The technique described by Uffenorde[54] may be modified to meet the needs of most cases. If the nasal septum is deflected to the obstructed side, a submucous resection, including the entire vomer, is performed. If the septum is not deflected to the affected side the posterior portion is all that need be removed. Elevation of the mucoperiosteal layer is then continued laterally across the posterior part of the nasal floor and across the anterior surface of the obstruction. Out-fracture of the inferior turbinate will improve the working room. Beinfield[58] recently described, with excellent illustrations, a method which appears to be a definite improvement. He fractured the inferior turbinate upward with marked improvement in the operating field.

After the bony obstruction has been removed, the mucoperiosteal layer is replaced. A flap is then prepared by making an incision across the upper part of the membrane overlying the choana, then passing down close to the nasal septum and laterally along the lower border. The flap may then be

laid back across the lateral edge of the cut surface. This will discourage granulation tissue from growing medialward into the new lumen.[25]

The mucous membrane, overlying the bony defect in the posterior part of the septum may then be removed, forming a single cavity posteriorly. This brings the healing surfaces farther apart and takes advantage of the fact that septal perforations usually stay open. If the amount of soft tissue thus removed is a little less than the amount of bone removed,

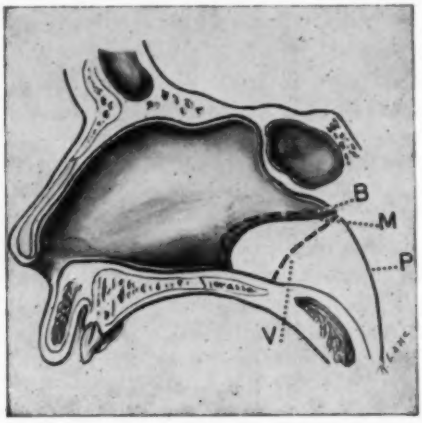

Fig. 5.

the edges of the mucosal layers will cover the edge of the bone and encourage more rapid healing (see Fig. 5). Removal of the posterior portion of the septum was first done in this country by White.[24] Katz[35] in 1913, and Uffenorde[54] in 1909, had previously mentioned this procedure. Uffenorde stated that Symonds and Haag resected the most posterior part of the septum to be sure of getting a lasting result.

The actual removal of the bony framework may be done by perforating it with a trephine, trocar, or hammer and gouge. The opening may then be enlarged with bur, biting forceps or curet. Some surgeons may choose the bur for the entire

procedure. Wilkerson and Cayce described this technique in detail.[15] Care must be exercised when working laterally, not to injure the palatine vessels and nerves, and when working superiorly, not to injure the nasopalatine artery as it crosses the under surface of the sphenoid. In perforating the partition some authors recommend that the surgeon insert a finger into the post-nasal space to prevent the instrument from injuring the posterior wall of the nasopharynx, or to act as a guide in the removal of the bony partition. This, of course, must be done with care in order to prevent injury to the surgeon's finger in the nasopharynx. Stewart[13] inserted a post-nasal pack. This appears to be a satisfactory protective measure.

In a case of unilateral atresia related by McNaught,[55] the bone was very thick, and chiseling was difficult because of the abnormal lowness of the sphenoid sinus; therefore, he removed a portion of the posterior end of the septum and left the bony occlusion *in situ* with good results. Two of the cases reviewed by Stewart[13] were treated in this manner.

In an infant with membranous atresia, the method described by Lemere[56] may be tried. He broke down the membranes with a small dull curet, and then used the back of the curet to dilate the openings. No attempt was made to bite or scrape away the membrane. The openings did not close.

Transpalatine Approach.

The transpalatine approach offers a much better exposure than the intranasal approach. It should be used in all cases where the nasal passages are so small that a good procedure cannot be performed by working through the anterior nares. This includes all infants and children, and many adults.

Ruddy[50] and Hanckel[30] have described, with illustrations, the technique of this operation as performed by several surgeons. It is interesting to note that in those cases where the new choanae closed with granulation tissue, mucosal flaps to cover the raw surface had not been made, and in some cases where the palatine vessels were not included in the palatal flap, the wound opened a few days after surgery.

Owens[22] operated upon 17 patients through this approach with good results. In order to insure a good blood supply, he included the palatine vessels in the palatal flap. All of his cases healed by primary union. He removed the obstructing plate with rongeurs. A submucous resection of the posterior bony part of the septum was then performed. The mucosal flap on the obstructed side of the septum was removed and the flap on the patent side was used to cover the upper raw surface where the bony diaphragm had been removed. Prior to performing this operation, one should read Owen's article and study his excellent illustrations. Owens[22b] stated that a unilateral atresia in a full-grown adult probably could be approached as well intraseptally.

Dickson's[19] technique did not include the palatine vessels in the palatal flap, but in addition to a mucosal flap similar to that described by Owens, he also prepared a flap from the mucous membrane on the posterior surface of the atresic wall. This flap was cut in such a manner that it could be laid over the lateral cut surface. The palatal flap healed by primary union, and there was very little difficulty with granulation tissue.

In case of bilateral atresia, the septal mucosa will be of little or no value in the preparation of a flap. It is, therefore, suggested that an attempt be made to preserve the mucous membrane on both the anterior and posterior surfaces of the bony diaphragm, one to cover the lateral cut surface and one to cover the superior cut surface.

CASE REPORTS.

Case 1. A 21-year-old white soldier was referred to the Ear, Nose, and Throat Clinic of Letterman Army Hospital because of recurrent attacks of acute tonsillitis.

Routine questioning further disclosed that he had been bothered with nasal obstruction and discharge, on the left side since birth. He was unable to clear the left nostril by blowing, and frequent wiping was necessary. The secretion was thick, and became more profuse on bending forward, or when exercising.

On physical examination, the following abnormalities were observed:

a. An accumulation of thick mucus on the floor of the left nasal cavity.

b. The nasal septum was deflected to the left posteriorly.

c. The floor of the left nasal fossa was approximately 3 mm. higher than the floor of the right nasal fossa.

d. The left inferior turbinate was violaceous in color and hypertrophied with an irregular surface.

e. Posterior rhinoscopy revealed complete closure of the left choana. The occluding wall was approximately 2 mm. anterior to the posterior border of the nasal septum and was smooth, except for a centrally located dimple.

f. The tonsils were moderately enlarged, the crypt orifices were stenosed, and the anterior pillars were reddened.

On Jan. 21, 1953, tonsillectomy was performed under local anesthesia. Recovery was uneventful.

On Feb. 19, 1953, under local anesthesia, a submucous resection of the posterior, thickened, deflected portion of the nasal septum was performed. Elevation of the mucoperiosteal flap was then continued over a bony hump on the floor of the left nasal fossa, just anterior to the choana. The hump was removed with chisel. This gave a good view of the atresic wall. Elevation of the mucoperiosteal flap was then extended over the obstruction. In so doing, the periosteal elevator slipped through the centrally located membranous portion, which appeared to be about 4 mm. in diameter. The bone was no more than 1 mm. in thickness. An attempt to develop flaps from the anterior layer of mucous membrane was unsuccessful. The bone was then removed with biting forceps. The posterior mucoperiosteal layer was then incised vertically, forming flaps which were folded into the nasal cavity. The posterior portion of the septum was not removed. A piece of dental wax was shaped into a tapering tube and placed into the nasal fossa, with its smaller end extending through the choana, care being taken not to displace the flaps. No other packing was used.

Postoperative bleeding was minimal, the wax tubes were removed four days later, and the patient was discharged from the hospital on the ninth postoperative day. At that time the left choana was nearly as large as the right, and breathing was normal.

One month after surgery, the left choana was completely healed and appeared to be approximately two-thirds as large as the right choana. He was breathing satisfactorily and there was no accumulation of mucus.

Follow-up, by letter, 18 months after surgery indicated that he was in excellent health, was having no trouble with his nose, and the sense of smell was as good on the left side as it was on the right side.

COMMENT.

Anesthesia in this case was satisfactory and the operation was technically not difficult.

Case 2. A 20-year-old white soldier stated that he had never been able to breathe through the right nostril, and that he was unable to blow the right side of his nose. In order to remove the accumulation of mucus, he had developed a maneuver, consisting of a quick turn of the head to the left. As the head came to a sudden stop, the mucus was thrown from the nostril and caught in a handkerchief, or allowed to fall to the ground. Usually it was necessary to clear the right nostril about four times daily. During attacks of acute rhinitis, with constant drainage, frequent wiping was necessary and the skin of the nostril and upper lip became

irritated, and at times excoriated, and during sleep the mucus frequently drained on his pillow. He had discovered that if he slept on his left side the left nostril became obstructed and mouth breathing was necessary.

In late October, 1955, a submucous resection of the nasal septum was performed. Following this he noticed that he was able to breathe better through the left nostril, but was still unable to breathe through the right one.

On Nov. 27, 1955, he was admitted to an Army Hospital, where the diagnosis of congenital choanal atresia, right side was made, and he was evacuated to Tokyo U. S. Army Hospital, arriving Dec. 2, 1955.

Physical examination revealed the following abnormalities:

a. The major portion of the septal cartilage was missing.

b. The right inferior turbinate was atrophic and the right nasal cavity was large.

c. Thick, tenacious mucus covered the posterior half of the right nasal floor.

d. Attempted forced inspiration through the right nostril was unsuccessful.

e. Probing with a cotton-tipped applicator revealed an obstruction, at the choana, which was resistant enough to contain bone.

f. With post-nasal mirror the atresic structure was seen, a few millimeters anterior to the posterior edge of the vomer. A dimple, or pit, was seen just above the center.

g. Mild facial asymmetry.

h. The right side of the palate was arched 3½ mm. higher than the left.

Roentgenograms revealed normal paranasal sinuses without asymmetry. Films taken after lipiodol instillation into the right nasal cavity failed to demonstrate even a minute perforation.

On Dec. 8, 1955, under local anesthesia, the right inferior turbinate was fractured outward. A submucous resection of the vomer was performed. The atresic structure was thin medially and contained no bone superiorly, and because of the irregular surface continuation of the periosteal elevation over its face was not successful. The nasal passage was narrow at the choana and the bony obstruction was thick laterally, and because of the danger of damaging the palatine vessels and nerves only a narrow opening was developed. Flaps were not well formed and the lateral raw surface was not covered. Complete removal of the posterior portion of the septum was not done. A soft rubber tube, 10 mm. in diameter, was passed through the right nasal passage into the nasopharynx, and a suture attached to its external end was fixed to the cheek with adhesive.

On the sixth postoperative day the tube was removed, and the right nasal cavity was lightly packed with gauze impregnated with bacitracin ointment.

On Dec. 19, the nasal packing was removed and the choana appeared adequate.

On Jan. 5, 1956, a small granulation on the lateral choanal wall was cauterized with silver nitrate stick.

Healing appeared complete by Jan. 24, 1956, and while the choana was

only approximately 10 mm. high and 5 mm. wide, it was satisfactory for normal physiology.

COMMENT.

Local anesthesia in this case was poor, bleeding was troublesome and the view of the atresic structure was poor. A speculum with long thin blades would have improved the working space and given a better view of the choanal region. Had the right inferior turbinate been fractured upward, as described by Beinfield,[58] I believe the operation would have been easier to perform.

SUMMARY.

The number of undiagnosed cases of bilateral choanal atresia, causing suffocation which results in death soon after birth, is small. It should be emphasized, however, that a more accurate estimate of this number may be made if patency of the choanae is tested in all infants who die shortly after birth.

The development of choanal atresia, including erroneous theories of causation, has been discussed. The atresic structure, whether it be membranous, membrano-osseous, or osseous, with the possible inclusion of some cartilage, may result from failure of the bucconasal membrane to be absorbed. The presence of cartilage in the partition may also be explained on the basis of an overgrowth, or extension, from the body of the sphenoid or the vomer, but may not be explained on the basis of an overgrowth of the palate bone—a membrane bone.

The term, "atresia" means imperforation. It is, therefore, incorrect to speak of "incomplete atresia". Atresic structures with minute perforations, however, are for all practical purposes complete, and, therefore, may be included under this title. Incomplete partitions which do not produce symptoms of nasal obstruction should not be included.

A hereditary tendency has been suggested in several families where two to six members were affected.

The diagnosis of bilateral choanal atresia should be suspect-

ed in all new-born infants who have difficult respiration, and in all patients who have symptoms of complete nasal obstruction. Adenoids in an infant never produce complete nasal obstruction.

Infants with bilateral atresia must be provided with an adequate oral airway until surgical relief can be accomplished. Feeding must be done by means of medicine dropper, spoon or stomach tube.

The transpalatine approach for surgical correction is recommended for infants, and older patients with small nasal passages, especially if the occluding structure contains bone.

The intranasal approach is recommended for those patients whose nasal passages are large enough for good exposure.

With either of these surgical approaches, the operation is more liable to be successful if the posterior part of the septum is removed, and if mucosal flaps are prepared and laid over part of the cut surface.

When the transpalatine approach is used, inclusion of the palatine vessels in the palatine flap insures a good blood supply which will aid primary union.

Acknowledgment is gratefully made to Mrs. Hilda Allen, Librarian of Letterman Army Hospital, for the translation of references 2a, c, 3, 35, 36, and 54, and for her enthusiastic support in obtaining all references possible.

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AMERICAN ASSOCIATION FOR CLEFT PALATE REHABILITATION.

The American Association for Cleft Palate Rehabilitation will hold its 16th Annual Convention at the St. Francis Hotel, San Francisco, Thursday, Friday and Saturday, April 24, 25 and 26, 1958.

This Association is composed of medical, dental and paramedical specialists who are interested in the rehabilitation of persons with cleft lips and palates. For further information write: Dept. of Otolaryngology, University of Iowa Hospitals, Iowa City, Iowa.

MATURATION OF HEARING ACUITY.

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As the field of audiology has developed, many hitherto neglected areas of hearing have received consideration. One of the areas which has benefited particularly by this development is that of children's hearing; yet with all the emphasis now being placed upon the problems of the hard-of-hearing or deaf child, little attention has been paid to the fact that children's hearing is being judged in relation to standards established for adults.

This was a point of major concern to the writer when *A Study of Children's Hearing as it Relates to Reading*[1] was undertaken in 1939 as a doctoral dissertation topic. A major hypothesis of that study was that children's hearing is maturational and, therefore, the norms established for adults are not an appropriate basis for the evaluation of the normalcy of children's hearing.

At that time a comprehensive review of the literature was made in the fields of medicine, education, psychology, sociology, speech and physics. Any potential leads were followed, yet only three authors were found who dealt specifically with this subject. As early as 1907 Bryant spoke very positively of such development when he said:

"The acuteness of normal hearing may be described by a curve which rises from zero at birth, attains its maximum at the completion of adolescence, and gradually declines to a very low point in old age. If anything prevents the normal rise of the curve during adolescence or depresses it to a point below normal, the subsequent curve is parallel to the normal approaching the abscissa at an early period and causing premature loss of efficient hearing."[2]

Bryant gave a chart as the supporting evidence for his

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statement. There were no data to indicate the extent of the groups from which the material was drawn. Foucault studied visual and auditory acuity in school children from six to 15 years of age.[3] From his data it seems clear that both visual and auditory acuity increase from six to 15. The 15-year-old group has a higher acuity than the small group of adults included in the study. Black studied 27 children four to eight years of age.[4] She concluded that there is no difference in the curves between these ages. She did find, however, that the hearing in these children is lower than for adults. She indicated that at 512 cps. the normal for children is 25 dbs. higher (less acute) than for adults.

Another source of data which would tend to substantiate the concept of hearing as a maturational phenomenon may be drawn from numerous surveys which have been made both with a general population and those made with school children. Several of these studies purport to show the extent of hearing deficiency among various age groups. For example, Chayer reported 11.0 per cent of the third grade showed some hearing defect, as compared with 7.0 per cent for the upper elementary grades, and 4.5 per cent for the junior high school people.[5] The conclusion drawn in that report was that the test was unreliable below the fourth grade, rather than any recognition of the possibility of age difference. This has been a very common error among many of the school survey test reports.

Kerridge and Saareste each also presented data showing the decrease in hearing deficiency with age.[6,7] It would seem that such data might well be interpreted affirmatively rather than the negative interpretation made of less hearing deficiency.

Even further substantiation of the hypothesis of hearing as maturational process was drawn from the United States Public Health Service Survey made in 1935-36.[8] In that study some 9,000 persons were given audiometric examinations with a 2-A audiometer. The age range of the persons studied was from eight to 90. There were examined 776 ears of persons under ten years of age, 1,698 ears examined of

children whose age was from ten to 14; 1,300 between 15 and 19, and 1,056 between 20 and 24. At every frequency the girls between ten and 14 have hearing which is superior to the younger girls. The same is true, but to a lesser extent, for the boys up through 1024 c.p.s. At 2048 and 8192 c.p.s. there is a slight difference in favor of the younger group. These groups are also superior to the older groups. These data seemed to suggest, as did Bryant, that there is an increase in hearing acuity up to a given age, and that beyond that age there is a decrease.

It was with these data in mind that the study here reported was undertaken; and it is because there has continued to be so little recognition of this situation that the data are again being presented for consideration. No exhaustive survey has been made of the literature since the original study, and only two additional references have come to my attention. Baker, in referring to an article by Banerjee stated: "He also found that hearing seemed to reach its maximum effectiveness at about the age of 12 years, which is before the maximum bodily development is reached, and then declines slowly."[9,10] More recently, Myklebust has presented evidence drawn from a group of 47 youngsters between the ages of three and five-and-a-half years. In his group there was a total of 61 children, but he reports that 14 of them could not be tested with the pure tone audiometer.[11] He found that: "The average threshold decreases toward the zero decibel line as the age increases."[12]

Whereas the Myklebust study is that of children up to the age of five-and-a-half, the study being currently reported takes its group from six years of age to a young adult level. By considering the results of the two studies it may be possible to gain a better understanding of the factor of maturation of hearing with age. Although the writer's study is considerably older it would seem that there is no great disparity between the populations. In speaking of those considered in his study Myklebust says:

"These children attended a nursery school in a suburb of a large metropolitan community. The socio-economic level

was upper middle class with approximately one-half of the families being in professional or managerial type of occupations. The subjects for the study were estimated to be slightly above average in ability and development. None of them presented known deviations physically or emotionally."[13]

The population of the writer's study consisted of 433 individuals from the University of Chicago or the Laboratory Training School of the University. It was not felt that this population was typical of the population in general but rather that it offered a relatively homogeneous socio-economic background. To the writer there was also a second big advantage in that many types of student personnel data were available. The students from the Laboratory Training School were taken by grade levels, but only those falling within certain age groups were considered in the final report. The University students were volunteers between the ages of 18 and 23. This was the age of the group upon which the basic hearing norms were established. Intellectually the group was superior, as indicated by the test scores. Medians for the five elementary grades, obtained with the Stanford Binet Intelligence Test, varied from 121 to 128. The range for individuals was from 97 to 179. At the seventh and tenth grade level other tests were used with relatively comparable results.

Since details of the testing situation and procedure were given in the earlier report, it will suffice to say that all audiometric tests were made in an isolated situation with a 6-B Western Electric audiometer.[14]

Because the writer was interested in finding any variations which might occur in hearing, the data were originally treated to show sex and/or laterality differences as well as those which relate to age. Consequently both means and medians were obtained for these smaller groupings rather than for the entire number of ears at any age level. From the original tables means have been calculated using all ears at a given age. These findings are presented in the Table herewith; also presented in the table are the data given by Myklebust. The Myklebust data are presented in the upper portion of the table while the reconstructed means from the writer's data are shown in the lower portion.

Since the means presented for the entire age level were not calculated from the original data, it was not possible to determine the standard deviations and hence the relative significance of these differences; however, the significance of the differences was determined for each of the smaller groups by testing the null hypothesis.[15] A summary of these original findings follows, in which a value significant at the 1 per cent level will be referred to as "highly significant" while a

MEANS OF AUDITORY ACUITY FOR THE DIFFERENT FREQUENCIES FOR VARIOUS AGE GROUPS.

Age	No. of Ears	128	256	500-512	1000-1024	2000-2048	4000-4096	8192	9747
3-1 to 3-6	5-6			14.16	14.16	14.00	12.00		
3-7 to 4-0	24-25			13.75	10.60	11.04	11.25		
4-1 to 4-6	20-22			13.75	10.45	10.23	12.00		
4-7 to 5-0	27-30			10.00	6.83	6.48	5.00		
5-1 to 5-6	9-10			4.00	3.50	.50	2.77		
6-0 to 6-11	90	8.51	8.64	.44	-2.61	-5.21	-5.21	-.27	1.03
7-0 to 7-11	110	4.43	5.06	-1.49	-4.61	-6.64	-7.06	-4.52	-4.06
8-0 to 8-11	92	2.96	2.49	-3.12	-6.18	-8.03	-7.52	-6.74	-5.41
10-0 to 10-11	100	2.28	2.75	-2.87	-5.84	-8.12	-8.59	-4.77	-5.16
12-0 to 12-11	92	.21	1.13	-3.38	-5.65	-7.00	-8.14	-6.62	-4.68
15-0 to 15-11	122	-.46	-.38	-6.12	-8.91	-9.72	-8.57	-11.14	-10.07
18-0 to 23-11	94	1.36	2.68	-4.13	-7.54	-8.22	-8.36	-7.29	-5.79

significance at the 5 per cent level will be referred to as "significant." Myklebust does not indicate the significance of the differences among the children he studied.

In summarizing the significance of the differences in the writer's group it may be stated that:

1. Between the six and 15-year-old girls all differences are highly significant, beyond the 1 per cent level of confidence. Between the boys of these same ages the differences fail to reach the highly significant level only at 4096 c.p.s. in each ear, and at 2048 c.p.s. in the left ear.

2. The differences between the six and eight-year-olds are significant except at 4096 c.p.s. with each ear of the girls and boys' right ears. The girls' right ears also fail to reach a level of significance at 2048 c.p.s.

3. In general there is a significant difference between the girls of eight and 15, but this difference is not so evident among the boys.

4. In no instance did the sex difference prove to be highly significant.

5. The laterality differences were highly significant only at 256 c.p.s. for the six-year-old boys and at 8192 c.p.s. for the 12-year-old girls.

Although not statistically significant, it is interesting to note that the boys were generally superior at the six and seven-year levels, while the girls scored higher at the ten-year level. At both the 15 and the adult level the girls were consistently superior in the left ear, but the difference was much less pronounced with the right ear.

It has been noted that, in general, there is a significant difference between the six and eight-year-old groups, and to a somewhat lesser extent between the eight and the 15-year-olds. It is interesting that when the means are considered, the ten-year-old boys seem to have somewhat less acute hearing than the eight-year-olds; however, in considering the means of the girls, the ten-year-olds exceed the eight-year-olds, but the 12-year-olds show some drop in comparison with the ten-year-olds. When medians are considered, the "drop" occurs most frequently at the 12-year level among both the boys and the girls. Certainly this would seem to indicate that the upper elementary grades may be a period of particular concern with regard to potential loss of hearing.

In conclusion, then, it may be said that:

1. Hearing is a maturational process without significant sex or laterality differences.

2. Like most other aspects of maturation this phenomenon does not present a straight line pattern but rather one of spurts and plateaus.

3. Different standards of hearing acuity are needed for the evaluation of different age groups below the adult level.

4. The failure to recognize age differences has resulted in misinterpretation concerning the feasibility and/or accuracy of hearing tests with young children.

5. Certain age groups deserve special attention in planning testing programs, because of the higher incidence of loss and the greater severity of difficulty at given age levels.

6. For no age group does the zero line appear to be flat.

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SURGERY VS. IRRADIATION IN THERAPY OF CONDUCTION DEAFNESS OF TUBAL ORIGIN.*†

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Conduction deafness secondary to impaired function of the Eustachian tube may be reversible if the diagnosis is made early enough and the treatment is adequate. What adequate treatment may be, is still a source of controversy, hinging mainly on the value of irradiation therapy. It is my opinion that irradiation therapy in any form has been overrated, and that the prevalent dependence upon it has resulted in missed opportunities in reversing salvable cases.

Impaired function of the Eustachian tube results from anything that partially or totally occludes it. Predominantly the factors are inflammation of the tube itself or compression by nasopharyngeal lymphoid tissue, especially in Rosenmüller's fossa. Secondarily are inflammatory diseases of the nose and sinuses, allergies, nasal and nasopharyngeal obstructions from neoplasms, polyps, congenital anomalies, etc.

The effects of tubal occlusion may be gradual retraction of the tympanic membrane and diminished motility of the ossicles from insufficient aeration of the middle ear, recurrent accute attacks of otitis media with subsequent scarring, chronic otitis media or recurring acute or chronic serous or secretory otitis media.

It has been observed that there is no lymphoid tissue in or about the normal Eustachian tube.[1,2] (Decker[3] stated it is not uncommon in children to find large hyperplastic lymphoid structures at the opening of the tube, but he did not indicate whether or not he considered this normal). Wolff[4] in routine

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histological examination of 47 tubes, found only a single tubal tonsil (the so-called Gerlach's tonsil) in one case, a child, who had otitis media. Farrior[1] stated that with chronic disease of the nose, nasopharynx and Eustachian tube, lymphoid nodules may appear anywhere in the subepithelial tissue, most frequently in the inferior aspect of the pharyngeal orifice of the tube and over the torus tubarius. He noted, also, lymph nodules high within the lumen of the tube and even within the middle ear itself, and stated that they may act as a mechanical factor in obstructing the lumen of the Eustachian tube. Semenov[2] referred to a case showing a lymphatic nodule obstructing the isthmus of the tube in a case of chronic suppurative otitis media, but he believed such instances to be rare for, in examining tubes of 200 cases of otitis media of all types, only three had nodules 1 mm. or more in size.

It must be concluded then, in therapy for tubal occlusion from lymphoid tissue, that attention should be focused upon the torus tubarius, the fossae of Rosenmüller, the salpingopharyngeal folds and the central adenoid mass.

How, then, should these lymphoid masses, primary or secondary, be treated? *1.* By surgical removal alone? *2.* By surgery plus irradiation for the primary cases? *3.* By surgery plus irradiation for the secondary cases? *4.* By irradiation only for the secondary cases? *5.* By re-irradiation? *6.* By primary irradiation?

Crowe and associates[5] believed that small doses of radiation, affecting both the inflammatory process and the lymphoid hyperplasia, are a definite adjunct in the treatment of partial tubal occlusion, in that lymphatic tissue is extremely susceptible to these small doses.

Garland, et al.[6] stated, "The treatment of choice in hyperplasia of the lymphoid tissue is radiation therapy, since this hyperplastic tissue is not amenable to surgery." This concept, of course, must be challenged. They reported having treated 720 patients referred by otolaryngologists and general practitioners for lymphoid hyperplasia in the nasopharynx with a relief of presenting signs or symptoms by the first course of Roentgen treatment in 60 to 90 per cent. Of the

rest, 5 per cent returned for additional irradiation with resultant improvement. Analysis of the report of these results is difficult, because some of the patients were referred by general practitioners whose qualifications for decision as to therapy in ear problems and evaluation of results are open to question; also, the statements of results by referring otolaryngologists suggest over-all impressions rather than detailed surveys.

Meltzer[7] stated, "The immediate effect of irradiation is on the secondary nodules, and manifests itself in these three stages: *1.* cessation of proliferative activity; *2.* conspicuous scavenger activity during which the destroyed cells are removed; *3.* depending upon the dosage used, the return of proliferative power. It must return, unless treatment has gone beyond the limits safe for non-neoplastic disease. Naturally, the greater the dosage, the quicker the ensuing destructive process; but eventually regeneration does occur. Schenck's studies have demonstrated that irradiation by any means—X-ray, radium, produces the same effects." Meltzer gave this as his reason for believing that irradiation can never replace surgery as a means of removing scattered lymphoid tissue, admitting that surgery is by no means the perfect solution.

Boies[8] observed that, in children, lymphoid follicles in Rosenmüller's fossae do not disappear completely after radon irradiation with as many as three exposures. He reported a favorable effect with the use of a radon applicator in a number of cases with a generalized decrease in hearing through the speech frequencies and the high notes. All the patients had had tonsils and adenoids removed with a variable amount of recurrent lymphoid tissue. He did, however, surgically remove the secondary masses of good size before irradiation, so from his report it is difficult to tell how much of this hearing improvement was due to irradiation and how much to surgical removal. Boies noted also that patients with hearing loss for frequencies higher than 2048 were not improved following irradiation.

Day[9] expressed disappointment and disillusion by his ex-

periences with the use of irradiation in conduction deafness. He could detect little gross change in the lymphoid tissue after irradiation. In less than 5 per cent of his cases did the irradiation appear to have any permanent effect on the patency of the Eustachian tube or ventilation of the middle ears. A few cases with obviously inflamed and infective lymphoid tissue were definitely helped.

Hoople,[10] after using a radium applicator for about a two-year period, became convinced that its use for infected lymphoid tissue is ineffective. Hoople stated, "I have seen numerous five-year follow-up audiograms of children who have been treated with radium, and in the aggregate, the hearing at the conclusion of this period showed no improvement over the pre-therapeutic hearing tests. . . . There is no purpose, however, to a controversy in the matter, since a carefully performed adenoidectomy abolishes the need for the use of radium."

My present point of view in selection of therapy is a complete about-face. In the mid-thirties, following Crowe's glowing reports of the value of irradiation, I became an advocate of this therapy. In a few years, however, my early enthusiasm faded when it became obvious that benefit, when obtained, was too often only temporary. Nasopharyngoscopic examination of these cases before and after irradiation showed no appreciable change in the size of the lymphoid masses or nodules. Irradiation was not the answer to the ear problem of tubal origin, in my experience.

As I watched my small adenoidectomized patients grow and the residual nasopharyngeal lymphoid tissue grow with them, it became apparent that the method of adenoidectomy then in vogue needed a change. A direct vision technique, not unlike many similar methods subsequently reported, was used, punching out the nubbins of tissue in the vault of the nasopharynx near the choanae and the septum, the collections of tissue in the fossae of Rosenmüller and the hyperplastic lymphoid tissue from the tori and salpingopharyngeal folds when necessary. Except in certain allergic individuals, significant recurrences of lymphoid tissue did not occur. The tubal-deafened youngsters became less of a problem.

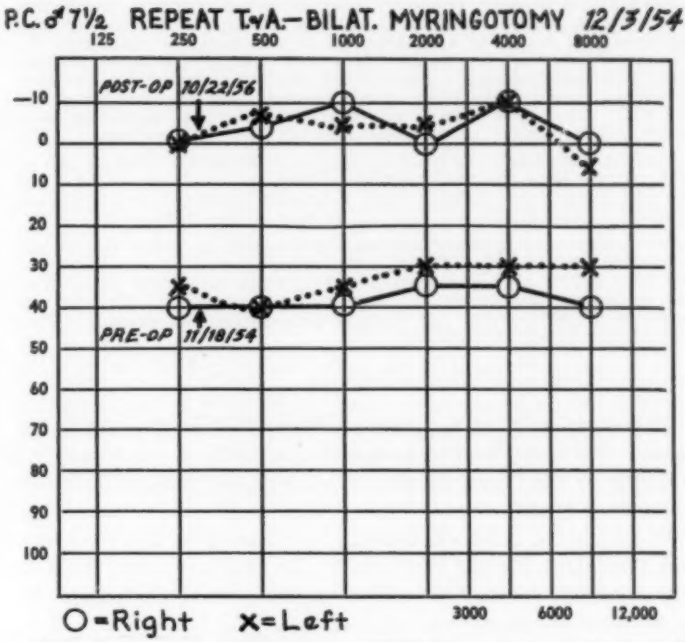

Fig. 1. Pre- and postoperative audiograms of P.C., a 7½-year-old boy with nasal allergy and conduction deafness. Course of X-ray irradiation to adenoids and tonsils at 1 and 2 years of age. Adenotonsillectomy at 3½ years. Deafness noted at 6, reversed at 7½ years by a second thorough adenotonsillectomy and bilateral myringotomy for secretory otitis media. Improvement maintained.

If I seem overly concerned about the present-day therapy of conduction-deafened children, it is because of the number of patients I have seen, whose previous management failed in its purpose. Illustrative of this is the following case report:

P.C., a seven-and-a-half-year-old boy, was first seen on Nov. 18, 1954, because of progressive deafness of at least a year's duration. Trouble with his ears started in infancy, within two weeks after birth, with recurrent attacks of otitis media. He had had X-ray therapy to his nasopharynx at the age of one, and a second course at the age of two, each followed by an improvement lasting only six months. At three-and-a-half years an adenotonsillectomy was performed. Its benefit lasted but seven months. The ear infections recurred. At six, hearing impairment was noted.

Examination revealed thickened, gray, retracted tympanic membranes and a severe conduction deafness, with an average decibel loss for the conversational range of approximately 35 for each ear (see Fig. 1). The nose showed a typical picture of a vasomotor rhinitis of the allergic type. Nasopharyngoscopic examination of the nasopharynx revealed abundant adenoid tissue in the vault, in each fossa of Rosenmüller, on the tori, and on the salpingopharyngeal folds. The appearance suggested hypertrophy of incompletely removed adenoid remnants.

Thorough surgical removal of the lymphoid tissue was done on Dec. 3, 1954. At the same time, bilateral myringotomies were done, and in each ear was found very thick, stringy, gelatinous substance which was so adherent to the middle ear that its aspiration was difficult.

There was an immediate hearing improvement to about the 15 db. level after surgery. Repeat audiograms were done at monthly intervals, and by June 17, 1955, the hearing had returned to normal level. The last audiogram done on Oct. 22, 1956, is shown in Fig. 1. This patient is one of the lucky ones; his deafness proved reversible in spite of the long history of ear involvement.

COMMENT.

The story of this patient is characteristic of many such cases. The individual is invariably one with a vasomotor instability on the basis, usually, of allergy, but sometimes from endocrine dysfunction. The deafness is often associated with middle ear fluid which must be removed by myringotomy and aspiration for the best result. Irradiation seems to have only a transient beneficial effect upon the masses of lymphoid tissue, and an incomplete adenoidectomy is not much better. It is true that even with the most efficient surgical technique, regeneration of lymphoid tissue in an allergic individual will recur. In cases with hearing problems, these recurrent masses should be removed surgically.

It is to be noted that in this case repeat audiograms monthly after surgery, were done. This is important, because it may be the only method by which middle ear fluid re-accumulation may be detected. Recurrent fluid should be removed, and supplementary irradiation may be considered. Unfortunately, in my difficult cases where there has been continued re-accumulation of middle ear fluid, supplementary irradiation has not been helpful. On the other hand, in some instances where irradiation had failed, subsequent surgical removal of lymphoid masses produced improvement. An example of this is the following case report:

Mr. J.P., age 45, was seen first in January, 1955, complaining of severe deafness in the left ear and moderate deafness in the right for "some

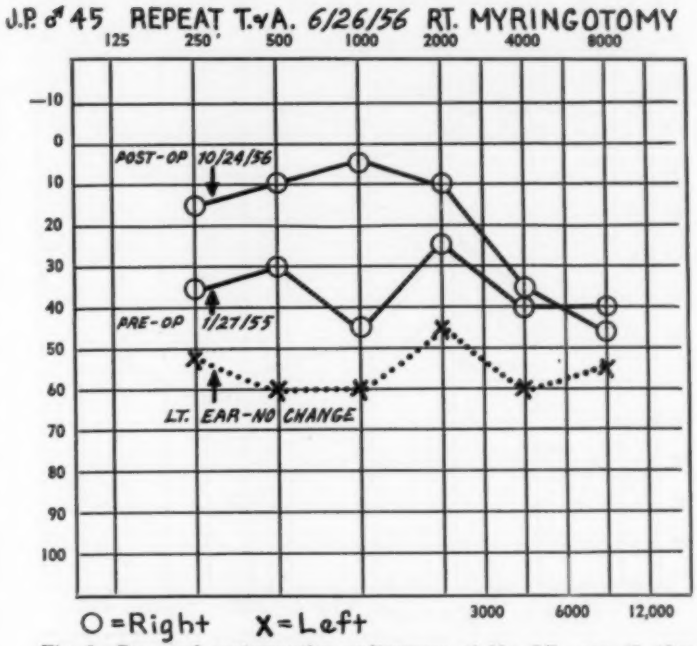

Fig. 2. Pre- and postoperative audiograms of Mr. J.P., age 45 (Jan., 1955). Chronic serous otitis media in right ear, chronic purulent otitis media in left. Course of X-ray irradiation to nasopharynx in May, 1947, and October, 1951, and one treatment with radium plaque, monel-filtered, in December, 1951. No improvement until nasopharyngeal lymphoid tissue and tonsil remnants were removed surgically in June, 1956.

time." He had had X-ray therapy to his nasopharynx, first in May, 1947, with seven treatments at weekly intervals and an average of 80 *r* administered each time for a total of 320 *r* to both right and left sides. Four and one-half years later, in October, 1951, he had a second series of treatments by the same roentgenologist. Approximately 100 *r* (250 KUP and a half-value-layer of 2.53 mm. of copper) were administered at weekly intervals for a total of 700 *r*. On Dec. 20, 1951, the patient was given one treatment (by the same person) with a 50 mg. radium plaque, Monel-filtered, against the Eustachian tubes for a period of eight minutes on each side. The patient was not certain as to whether or not the hearing was improved by these treatments.

Physical examination showed evidence of a serous otitis media in the right ear, confirmed by myringotomy, and a chronic otitis media with purulent drainage in the left. The average decibel loss for the conversational range was 33 for the right ear and 70 for the left. Nasopharyngoscopic examination revealed a considerable amount of lymphoid tissue centrally and in each fossa of Rosenmüller, more on the right. After a period of observation and repeated right myringotomies, the

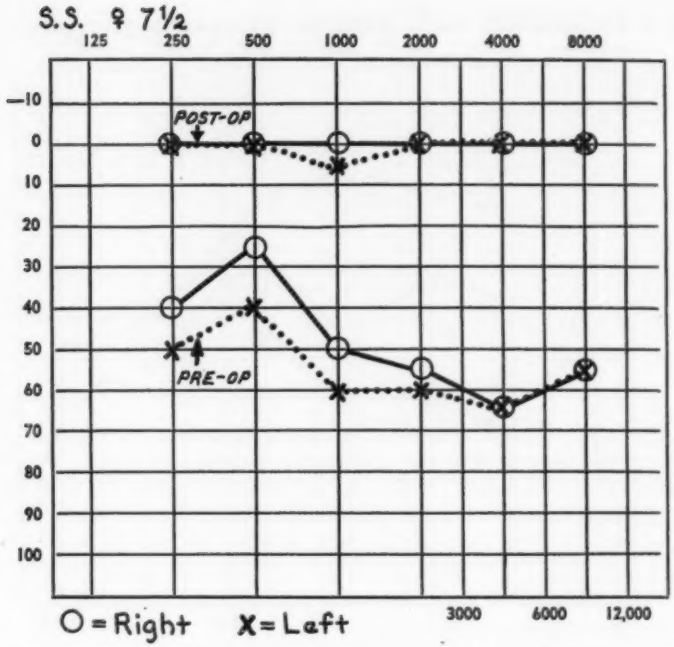

Fig. 3. Pre- and postoperative audiograms of S.S., a 7½-year-old girl. The surgery, a secondary adeno-tonsillectomy, was supplemented with Roentgen irradiation. This was one of a series whose good results were thought, at the time, to be due to the combination of surgery and irradiation, but subsequent controls (see Figs. 4, 5, 6, 7) suggest that adequate surgery was responsible for the improvement.

patient was advised to have surgery for removal of the nasopharyngeal lymphoid tissue and tonsil tags. He refused, but continued to submit to repeated incisions of his right tympanic membrane to obtain hearing improvement, though transient, in his only hearing ear. Finally, in June, 1956, he submitted to a "secondary" adenotonsillectomy. Tissue examination revealed "chronic inflammation and reactive hyperplasia." Following surgery, the hearing in the right ear improved (see Fig. 2) and the serous otitis media disappeared. It has not recurred.

The primary use of irradiation without surgery for the adenoids has very little in its favor. In the doses used, irradiation has little effect on masses of tonsil and adenoid tissue, and in the light of Clark's[11] recent report of cancer of the thyroid in children who had had irradiation to the head and neck, or neck and chest, for various reasons when they were

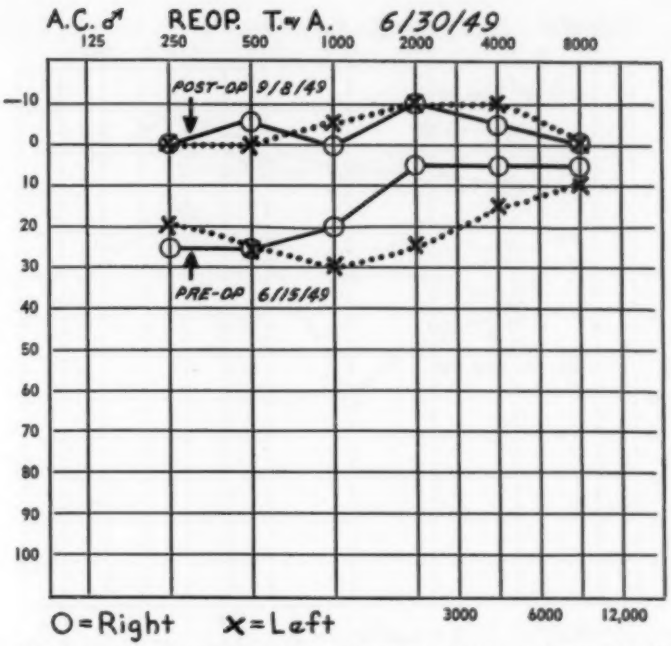

Fig. 4. Pre- and postoperative audiograms of A.C., a 9-year-old boy with nasal allergy. Previous adenotonsillectomy at 4½. Nasopharyngeal irradiation advised elsewhere for conduction deafness, but refused. Surgical removal of residual and recurrent adenoids and tonsils reversed the deafness. Recheck 6 years later showed that the improvement was maintained excepting at 8000 c.p.s.

from two months to six years old, it may not be without hazard.

Should thorough adenoid surgery be supplemented routinely with postoperative irradiation in the conduction-deafened patient? For a short period in my career this routine was used, for the results were impressive (see Fig. 3); however, supplementary irradiation was discontinued when it was learned, after running some controls, that equally good results were obtained with adequate surgery alone (see Figs. 4, 5, 6, 7). It became apparent that irradiation had been given the credit which the surgery deserved.

The choice as to type of irradiation, Roentgen-ray, radon

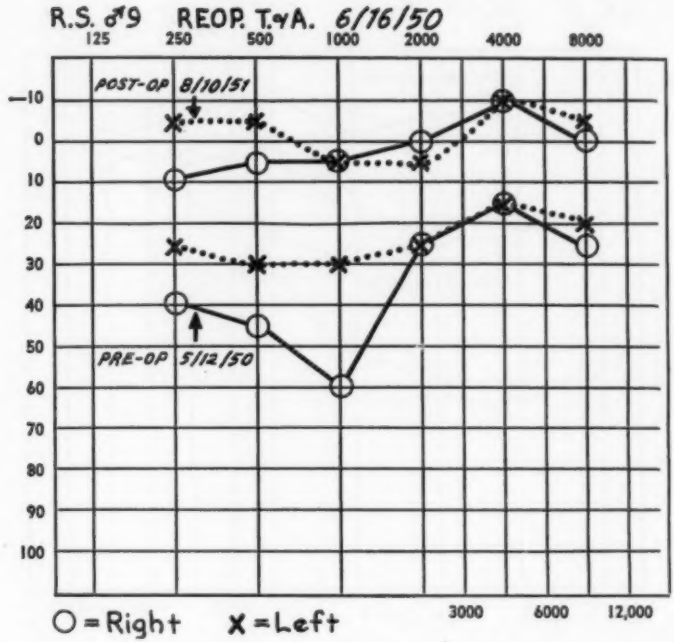

Fig. 5. Pre- and postoperative audiograms of R.S., a 9-year-old boy with nasal allergy and conduction deafness. Previous adenotonsillectomy at 5. Roentgen therapy was considered but not done before second adenotonsillectomy. Deafness reversed. Improvement maintained.

or radium applicator, has not been discussed because it is not within the scope of this presentation. The proponents[12] of the radon or radium applicator say that it is effective and harmless, and that X-ray irradiation may be hazardous. On the other hand, the advocates of X-ray therapy[6] claim that X-ray irradiation is very effective with a more homogenous dosage and without danger, and point out that the radium applicator gives a very heavy irradiation that is not administered to any other non-malignant condition.[13] In the few cases in which I recommend irradiation, the therapy given is X-ray irradiation by a roentgenologist. While this claim of the safety of X-ray irradiation may be true, one occasionally encounters a case that casts some doubt upon this belief.

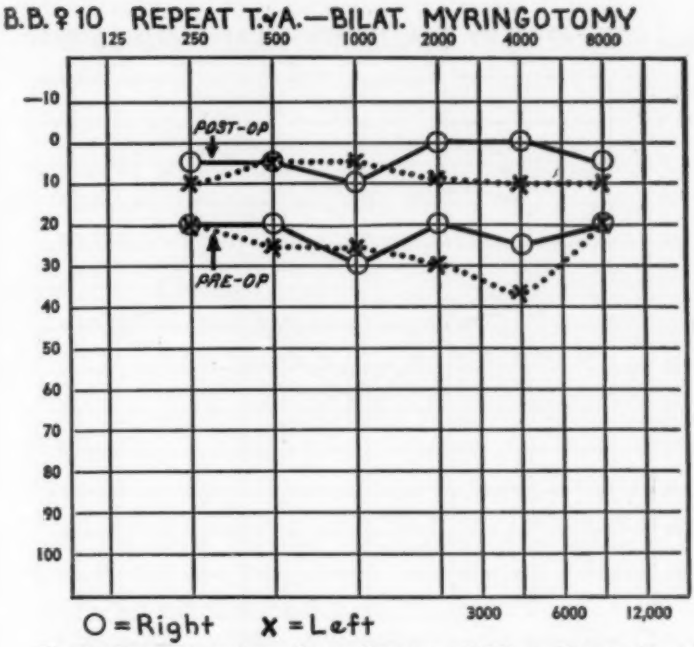

Fig. 6. Pre- and postoperative audiograms of B.B., a 10-year-old girl with secretory otitis media and conduction deafness. Previous adenotonsillectomy at 4½. Roentgen therapy to nasopharynx, prescribed by an otolaryngologist, did not improve the secretory otitis media or the deafness, which were subsequently treated with a second adenotonsillectomy and bilateral myringotomy. Immediate hearing improvement resulted. Improvement maintained.

Such a case is one now reported through the courtesy of Dr. H. W. Kohlmoos who, in 1950, saw this 12-year-old girl with a right serous otitis media.

She had had a previous adenotonsillectomy. Recurrent nasopharyngeal lymphoid tissue was present, more on the right. She was referred for Roentgen irradiation and received a total of 600 *r* from Aug. 22 to Sept. 16, 1950. She did not return until October, 1956, at the age of 18, when she complained of left ear deafness. Examination disclosed a left serous otitis media and a left nasopharyngeal mass. Biopsy of this showed transitional cell carcinoma. The occurrence of this type of malignancy in one so young certainly makes one wonder if the irradiation at 12 and the cancer at 18 were not more than just a coincidence.

It is difficult for me to reconcile the glowing reports of irradiation and the continued urging of its use, with my

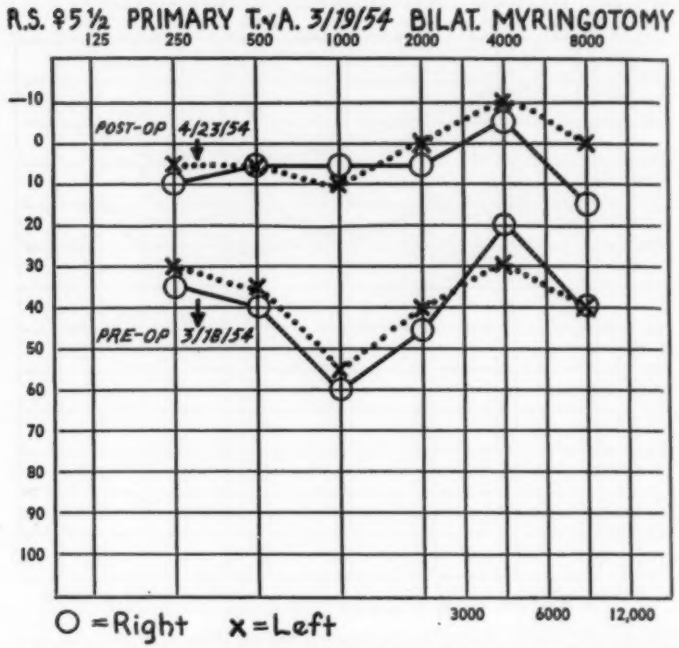

Fig. 7. Pre- and postoperative audiograms of R.S., a 5½-year-old girl with bilateral serous otitis media and conduction deafness. The complete reversal of the conduction deafness is a typical example of what can be accomplished with a thorough, primary adenotonsillectomy and bilateral myringotomy without subsequent nasopharyngeal irradiation. Hearing in this patient has been maintained.

own experiences. It may be that the authors have not appreciated the benefits of a meticulous adenoidectomy or that they have less of the "problem" cases than I encounter. Surgery does not solve every problem, but it comes close to doing so.

One would expect that, by now, all otolaryngologists would inspect the nasopharynx with a suitable palate retractor before considering the adenoidectomy completed; yet, in my own community I have observed too many limiting the procedure to a few swipes with a curette plus finger palpation. The finger is not reliable and the curette cannot remove the

tissue in the fossae of Rosenmüller. The tori and the salpingopharyngeal folds obviously are ignored.

SUMMARY AND CONCLUSIONS.

Lymphoid tissue is the predominant factor in conduction deafness of tubal origin. This deafness is reversible if the treatment is adequate and not too late.

Treatment should be focused on the tonsils as well as the adenoids for the part they play in the infection that contributes to tubal obstruction. Concomitant therapy for allergy and nasal and sinus infections should be given when these conditions are associated.

The most effective treatment of nasopharyngeal lymphoid tissue (and tonsils), primary or secondary, is meticulous surgery which has no therapeutic equal.[14,15]

Irradiation in any form has been overrated in its ability to shrink lymphoid tissue with the dosage considered to be within the range of safety. If some shrinkage occurs it is transient, for it is followed by regeneration. This would explain why the benefits are usually temporary.

If irradiation is used it should be resorted to only after thorough surgery has been tried. If irradiation is limited to these patients, the number exposed to this therapy will be small.

Irradiation is not and should not be used as a substitute for good surgery, or as an escape for inadequate surgery.

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TEMPLE UNIVERSITY SCHOOL OF MEDICINE AND HOSPITAL.

Postgraduate Course in Bronchoesophagology, January 13-24, 1958; March 24-April 4, 1958. These courses are to be given in the Departent of Laryngology and Broncho-Esophagology, Temple University Medical Center, under the direction of Doctors Chevalier L. Jackson and Charles M. Morris.

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NEW INSTRUMENTARIUM FOR PERORAL ENDOSCOPY AND ENDOSCOPIC PHOTOGRAPHY.*

CHEVALIER L. JACKSON, M.D., F.A.C.S.,†

Philadelphia, Pa.

I acknowledge the indebtedness I owe to a criticism made several years ago in a review of our textbook, "Bronchoesophagology". This review appeared in the *British Medical Journal*, written by a distinguished British surgeon. The heading was "Bronchoscopy and Oesophagoscopy," even though the book that was being reviewed was entitled "Bronchoesophagology". In the first paragraph of the review, referring to this title the reviewer says, "The horrid title is defended by the explanation that the book sets out to do more than present the bare bones of endoscopy, and tries to give the whole picture of the diseases of the bronchi and oesophagus."

That "horrid title" has been widely accepted all over the world—the word "bronchoesophagology" or its equivalent, is now unhesitatingly used in many languages. This review is neither unfriendly nor unkind. It is very laudatory in many parts, but the part I quote from, which was an inspiration to us, is the critical part: "There is, however, one big criticism that must be made: It is not meant to belittle, and in some ways it is embarrassing to make it, in view of the ripe experience of and the respect due to a pioneer of the quality of the senior author. It is now well over a quarter of a century since the bronchoscopic and oesophagoscopic technique, as described in this book, was established at Philadelphia. It was a triumph of organization and performance, allowing safety and success to be achieved. Very large numbers of pupils have been taught these methods with great advantage to everyone. Yet there has been almost no signifi-

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†From the Chevalier Jackson Clinic, Temple University Medical Center, Philadelphia.

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cant change in the basic technique, and in the instruments used. The elaborate headholding technique, for instance, is a quite unnecessary waste of manpower, and rather pathetic when one sees it slavishly followed by devotees in many places. It seems to be in danger of becoming a traditional ritual indulged in by the disciples of the Jackson school.

Fig. 1. New type Jackson bronchoscope. Note changes in both proximal and distal ends. The distal rim has been removed, the diameter flares proximally and the handle has been reduced to a "tear-drop". The short tube for detachment of tubing has been slightly curved.

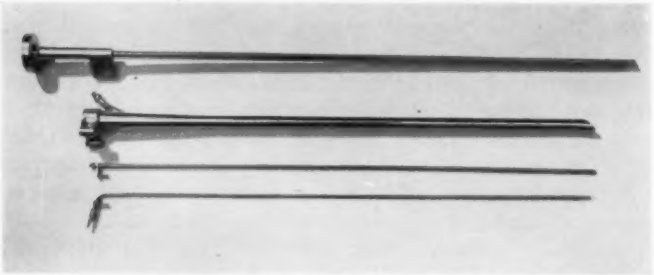

Fig. 2. The Jackson "fotobronchoscope" (after Fourestier, Gladu and Vulmière).

"The same criticism applies to the bronchoscopes and oesophagoscopes used. These also have remained unchanged throughout the years, presumably because they are thought to have achieved perfection. The jealous guarding of their design is also fast becoming a tradition, for they have been outdated and outmoded by other instruments, just as the motor cars of the same vintage have been replaced by later and more efficient models. The continued unquestioned ac-

ceptance of these obsolete instruments by the devotees is somewhat remarkable. If this state of affairs continues much longer, the Jackson type of bronchoscope and oesophagoscope will attain a dignity due to custom and usage only comparable to that of a sacramental weapon or staff. Sooner or later the break will have to come, unless it is to remain as unchanged as Holy Writ.

"The bronchoscopes are very wasteful of space. The wall is unnecessarily thick compared with the lumen, and even the effectiveness of this is further encroached upon by the excessive projection of the light-carrier channel. The lip of the instrument is also too big and clumsy, especially in the smaller

Fig. 3. The Jackson fotobronchoscope assembled, with French "eclaireur" attached.

sizes, when every fraction of a millimeter counts. The Negus type of instrument, which has been used for many years in Britain and has almost completely displaced the Jackson instruments, has none of these disadvantages; the size and construction are as economical as possible, and give a much more generous view and operating space. The objections to the Jackson type of oesophagoscope are less serious, but the Negus type of instrument is similarly much more efficient.

"Your reviewer is anxious to repeat that these criticisms are made only with a full sense of the respect due to the great contributions and pioneer work of the Jackson School, and are not meant to be unkind or disparaging. The book itself

should be familiar to all those whether thoracic surgeons or physicians or 'bronchoesophagologists', who have to deal with the esophagus and air passages."

Mr. Brock's review[1] was just one of the stimuli that influenced us, not suddenly or just for one week or one month, or one year, but over a period of years in developing the endoscopic instruments herein described, which are now in current use in our clinic.

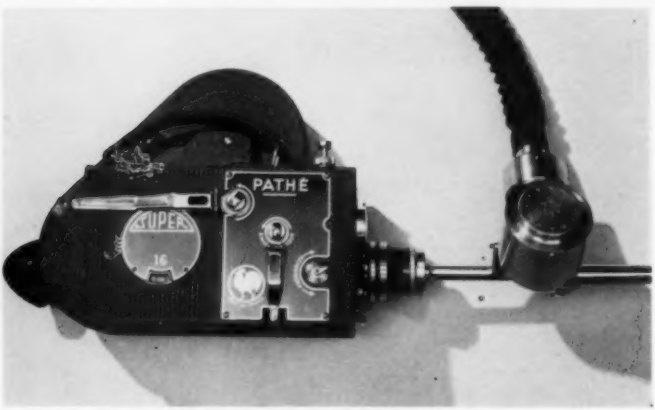

Fig. 4. Pathé reflex camera (16 mm.) shown attached to fotobronchoscope; 8 mm. camera or still camera, preferably of reflex type can be used in the same way. The new Bolex Reflex is quite similar to the Pathé, with a slightly brighter image in the reflex finder, but neither is nearly as bright as the image in the Camex Reflex (8 mm.) finder.

In the new bronchoscopes we have, first of all, eliminated the rim at the distal end. The edge of the metal used in the tubing is not cutting or traumatizing. It is almost what we call a "butterknife" edge. We feel this is not dangerous if properly used, and we feel that elimination of the rim is a great improvement. As for the proximal end of the tube, we have adopted a proximal flare of diameter, making the diameter at the proximal end greater than in the distal portion of the tube, though it is the diameter at the distal end that determines the size of the particular scope.

The new bronchoscopes are made in the following sizes:

7 mm. x 40 cm., 6 mm x 35 cm., 5 mm. x 30 cm., and 4 mm. x 30 cm. Introduction of aspirator tubes, forceps and other instruments is greatly facilitated by the design of the new scope, and certainly as soon as you have used one of the new instruments with this feature of easier entrance of all auxiliary intruments, and then go back to the old type with the flat proximal surface and the small proximal lumen, you will be immediately impressed with the advantage of the newer type. The other changes are the elimination of the heavy handle,

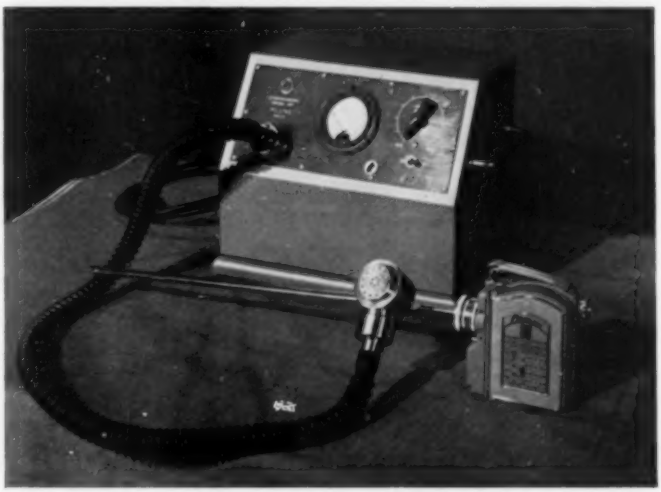

Fig. 5. Complete outfit for bronchoscopic photography seen assembled, including Ercsam Reflex (8 mm.) camera and Pilling-made unit containing rheostat for illumination and blower for cooling by suction.

which was inclined to throw the instrument out of balance, and a change in the curve of the short tube to which the aspirating tube is attached. I do not mean to say that this bronchoscope is finally perfected, but I think it represents a definite progress in developing the Jackson type instrument.

The esophagoscope has been improved in similar fashion. We are making esophagoscopes in two models; round and oval, because it appears that some esophagoscopists definitely

prefer to use the oval tube. We have always preferred the round tube and still do, but there are advantages in the oval tube; certainly if you are used to it, it is preferable.

The next instrument is the "fotobronchoscope". The "fotobronchoscope," entirely American-made by Pilling, is a quartz

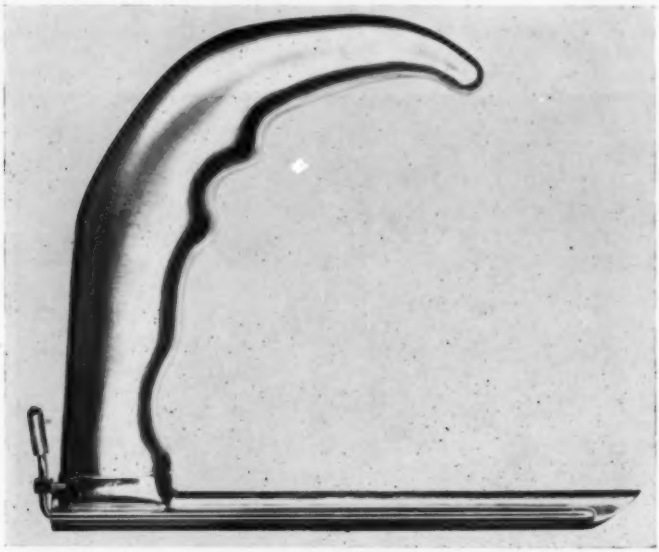

Fig. 6. New type Jackson laryngoscope. This particular instrument shows smooth tip tube, but various other types will be available; the essential new feature is the handle.

rod illuminated photographic bronchoscope very similar to the Fourestier Universal Bronchoscope, made in France. We acknowledge fully our indebtedness to that instrument because the American instrument, while not an exact duplicate, is the same in principle; and the illuminator or "éclaireur" used is *exactly the same* as that designed and perfected by the Institut d'Optique for Fourestier, Gladu and Vulmière,[2] under the protection of the French Centre de Recherche Scientifique.

The essential principle of this fotobronchoscope is the use of the quartz rod to carry the light from the proximal illuminator down to the end of the tube. The instrument uses really a combination of proximal and distal lighting, because while the light is delivered at the distal end of the tube, it is *conveyed* down the tube from a proximal illuminator. The loss is only 10 or 15 per cent in the transmission of light through this quartz rod. The quartz rod has to be made specially with meticulous care; it is cut, polished and sheathed in metal. The illuminator is attached in such a way that the concentrated light comes out of a small opening and goes down through the quartz rod to the distal end of the tube. You can introduce this bronchoscope with the regular Jackson-type light carrier first, and it is generally better to do that, especially if excess secretions are present, so that they may be aspirated before introduction of the quartz rod or telescope. The telescope through which the image is seen beautifully and brilliantly enlarged, contains at its distal end a little opening through which a jet of air passes to prevent fogging. This "antibuée" feature seems helpful in keeping the field clear. Through the large tubing comes a current of air under negative from the pump for cooling the lamp, as well as the little jet of air under positive pressure to prevent fogging.

A detailed description of the French instrument has been published recently by Dubois de Montreynaud[3,4] of Reims. Dubois de Montreynaud tells in his article the advantages of this technique for routine use in the endoscopic clinic.

Finally, the last instrument which I wish to present is a new type laryngoscope. For a long time I have felt that the handle of the standard classic laryngoscope was uncomfortable to hold, especially in cases where it is necessary to exert considerable lifting pressure, and the handle has seemed to me not very functional; so I felt that we should try to design a handle which would be comfortable eo hold in the regular position for introduction, and which would permit effective lifting at the end of the handle when heavy lifting is necessary.

There were two reasons for the large diameter of the handle: first, the fact that we thought the large handle

would be comfortable to grasp; second, that we had in mind the making of a self-contained battery in the handle model. It is quite possible that we may subsequently bring out a similar model, slimmer in diameter. Of course, the new laryngoscope will be available in various sizes and types with various types of tubes.

Other new features of our instrumentatium on which we are now at work are an improved push on cord terminal lumen similar to that used with the Sunbeam razor, to replace the present "bayonet" type, and a new lens-front lamp which will give better light and be longer lasting than the present type.

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AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY HOME STUDY COURSES.

The 1957-1958 Home Study Courses in the basic sciences related to ophthalmology and otolaryngology, which are offered at the American Academy of Ophthalmology and Otolaryngology, will begin September 1 and continue for a period of ten months. Detailed information and application forms can be secured from Dr. William L. Benedict, executive secretary-treasurer of the Academy, 15 Second Street S. W., Rochester, Minn. Registrations should be completed before August 15.

HYPERTROPHIED LINGUAL TONSILS.*

G. EDWARD TREMBLE, M.D.,

Montreal, Canada.

In a routine otolaryngological examination the surgeon carefully inspects each part of our field after obtaining a detailed history from the patient. As a rule, he checks the ears, nose, sinuses, pharynx, nasopharynx and larynx and notes any abnormalities.

If the complaints are referable to the throat, he pays particular attention to the mouth and pharynx, including the mucous membrane, teeth, gums, etc., and then concentrates on the tonsils. He looks into the nasopharynx by means of the mirror, examines the larynx and sums up his findings. Too often he omits the base of the tongue unless the epiglottis is pressed backward by a swelling obstructing a clear view of the cords. When this portion of the tongue is hypertrophic and nodular and is likely to cause symptoms, the laryngologist examines the lymphoid tissue here more thoroughly. This seems to be the usual procedure.

Although a definite component of Waldeyer's ring, the lingual tonsil has been neglected by medical men in general, and too often by laryngologists. This is evident by the lack of references in the literature during the past 50 years.

A recent case, which at first suggested a lingual tonsillitis, proved on section to be malignant, and emphasized the importance of a thorough examination of this area. The fact that this patient was a personal friend made it all the more distressing.

Anyone who is familiar with a laryngeal mirror should have no difficulty in recognizing whether lymphoid tissue on the pharyngeal surface of the tongue is within normal limits or is hypertrophied.

*Presented at the Sixteenth Annual Spring Convention, University of Oregon, Medical School, Portland, Oregon, March 26, 1957.

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As a rule lingual tonsils appear as flat, discrete nodules of lymphoid tissue which are situated on each side of the pharyngeal surface of the tongue between the circumvallate papillae and the valleculae. Laterally they join the inferior pole of the palatine tonsils. When hypertrophied, the nodules coalesce and become heaped up, forming a large mass on each side of the midline. At times when this occurs it is difficult to distinguish between the lower pole of the tonsil and the lingual portion. If these masses of lymphoid tissue are well developed a longitudinal fibrous band over the center of the tongue can often be seen, which extends backward as the median glossoepiglottic ligament. The lingual tonsil is separated from the musculature of the tongue by a thin, fibrous capsule similar to that which surrounds the palatine tonsil.

The nodules which comprise this lymphoid tissue have crypts, but they are fewer in number and not so deep as those found elsewhere. Each discrete follicle has two or three openings or pockets which extend downward almost to the tough, fibrous capsule.[1] Numerous mucus-forming glands open on to the surface near the base of the nodules and supply the necessary moisture to the tongue. Although these mucus glands were first noted 130 years ago, it is still questionable whether they open into the crypts or directly on to the surface. The epithelium covering the nodules is squamous in character to withstand the friction of food, in contrast to the high cylindrical ciliated cells on the adenoid.

Histologically the lymphoid tissue on the tongue is identical to that of the palatine tonsils. Quoting from a previous article on the "Tonsil and Adenoid Problem", "The microscopic structure of the lymphatic tissue in man and animals is everywhere the same. It consists of two distinct anatomic elements, parenchyma and secondary nodules. The latter, characteristic of, and found exclusively in lymphatic tissue, are round or oval formations and consist of a light center and a dark marginal zone. The light center contains numerous cells with a large amount of protoplasm which stain faintly and make the centers stand out as lighter foci in the parenchyma. These cells are of an exquisite phagocytic nature and are called macrophages. They contain dark

particles, first observed by Flemming (1885) and interpreted as products of cell metabolism. Not knowing their nature, he called them simply 'tingible corpuscles'. The marginal zone of the secondary nodules consists of densely packed lymphocytes and appears, therefore, in the slides as a dark ring . . . "

The main secret of the lymphatic tissue centers around the secondary nodules. Flemming, on the basis of numerous

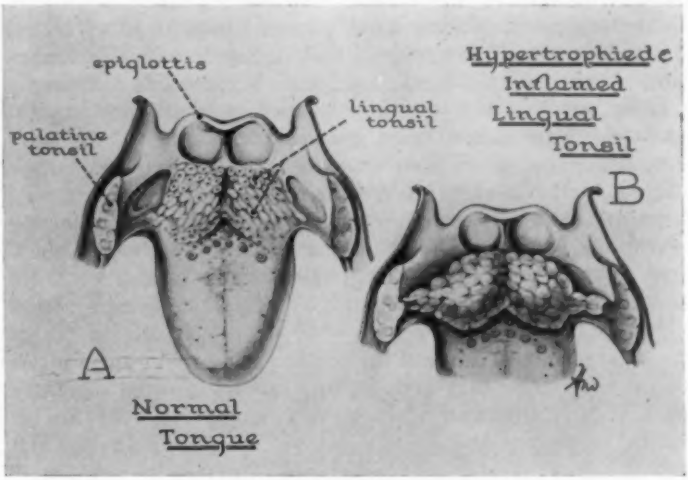

Fig. 1.

mitotic figures in them, concluded that they are main production sites for the formation of lymphocytes of the blood, which originate in the light center of the secondary nodules and are deposited in the dark marginal zone, which consists of newly formed lymphocytes. On account of this hemopoietic function, he named these secondary nodules "germinative centers."

Later observers doubted this interpretation; they laid the lymphocytic production to the parenchyma and attributed to the secondary nodules primarily some other function. Hell-

man and his school have regarded them as "reaction or defense centers" against toxic and bacterial irritants of low intensity continually invading the lymphatic tissue. The numerous mitotic figures on which Flemming built up his theory of the production of new lymphocytes may as well be explained as a reactive process following the invasion of toxic substances. Further reasons for this argument are: The "tingible corpuscles" could not be explained by Flemming himself. They are easily explainable as remainders of destroyed cells and nuclear fragments, and can even be expected there if the secondary nodules are reactive centers. Secondary nodules appear only several months after birth; in the fetuus and the newborn, they do not occur. The formation of lymphocytes starts during embryonic life and is extensive during the last fetal months and the first postnatal months. This means that lymphocytes appear in the body long before secondary nodules appear; so the latter cannot be the production centers of the former, and furthermore, bacteria injected into rabbits provoke extensive formation of secondary nodules. Finally, some crucial experiments show that guinea pigs reared completely sterile and free from bacteria in ingeniously constructed glass containers, from birth to two months of age—that is, to the age in which secondary nodules are well formed in the normal guinea pig—do not show secondary nodules, and rabbits infected regularly with a daily injection of bacteria from birth to the age in which secondary nodules are not yet formed in the normal rabbit—show secondary nodules prematurely, in about half the time of the normal development.

All this evidence is strongly in favor of Hellman's defensive theory and against Flemming's hemopoietic theory.[2]

In acute and chronic infections there is a marked proliferation of the secondary nodules with a resultant hypertrophy.[3] The light central area of the secondary nodules shows a great increase in the number of cells. This hyperplasia affects all the cells including the lymphocytes, plasma cells and polymorphs, as well as the reticular network. Many mitotic cells are also visible.

In other words, all the acute infections that involve the palatine tonsils, for instance, can also appear on the lingual tonsils and to the same degree. There may be parenchymatous inflammation for example, or a follicular tonsillitis which sometimes goes on to a localized abscess or quinsy. Keratosis in this area is also occasionally seen. When acute infections are repeated there is a tendency for this tissue to build up. This hypertrophy extends to the underlying capsule and the deeper mucus-secreting glands.

The symptoms vary a great deal when the lingual tonsils are inflamed or enlarged. Patients sometimes complain of a scratchy sensation, or a tickling cough especially at bedtime. A constant feeling of wanting to clear the throat or to swallow are common complaints. Pain low down in the throat at the level of the hyoid bone is very suggestive of this condition. At times patients say there is a fullness or tightness of the throat as though they were swallowing over a lump, symptoms often associated with globus hystericus. When these complaints occur in middle-aged women they are often thought to be due to the menopause.

Under normal conditions the flat isolated nodules at the base of the tongue do not cause any discomfort; however, a very slight redness or swelling of this tissue in a person with an unstable nervous system may cause symptoms greatly out of proportion to the findings seen. As a result, in a routine examination, a laryngologist is liable to think of such a patient as being slightly neurotic. Acute lingual inflammation is not seen as frequently as the conventional follicular tonsillitis, but the symptoms are similar, although not as a rule as severe; however, at times the sore throat is accompanied by chills, fever and prostration. Discomfort on swallowing is usually just above the thyroid cartilage and to one or other side of the midline, depending on whether one or both sides are involved. When the palatine tonsils are affected the sore throat is higher and the cervical glands below the angle of the jaw are enlarged and tender. Lingual tonsillitis, instead of being a self-limited infection of three or four days' duration, is liable to persist and become subacute. At times a low grade infection can become chronic

and go on for weeks or months. Occasionally the masses of lymphoid tissue press on the epiglottis and interfere with swallowing; sometimes voice changes also occur.

As mentioned previously, the crypts are shorter and the openings on the surface larger than in the palatine tonsils. In spite of this, cheesy plugs or frank pus are often retained in these pockets, and may be the cause of a bad taste or offensive breath. Infection here as in other lymphoid tissue can be responsible for muscular aches and joint disabilities.

Treatment, of course, depends upon whether the condition is acute or chronic, and the severity of the complaints. In the early stages treatment is the same as for any other acute sore throat. Hot saline irrigations, fluids, sedatives and the appropriate antibiotics are indicated. Many patients have faith in a gargle, but painting the inflamed surface with an astringent is usually more effective. Hot compresses on the sides of the neck bring more blood to the area and are generally very soothing. Most acute infections respond to this form of therapy.

If the condition progresses and an abscess forms, it should be opened unless it ruptures spontaneously. On rare occasions there may be enough swelling to cause dyspnea. When this occurs, tracheotomy must be kept in mind. Repeated attacks of lingual tonsillitis suggest that the sinuses are the underlying cause, and they should be carefully examined. Infectious mononucleosis, of course, should always be kept in mind.

Various forms of treatment have been recommended in cases of chronic hypertrophy. Again, the degree of thickening and the amount of discomfort are the deciding factor.

From the time the electric cautery was developed and used in otolaryngology all types of redundant tissue have been cauterized. Hypertrophied turbinates, bleeding vessels, tonsil tissue, especially remnants; fibromas in the mouth, etc., have all been subjected to this form of treatment. Due to the surface destruction of tissue with resultant dryness and crusting, this enthusiasm has waned to the point that most nose and throat men reserve the cautery for septal bleeding.

Hypertrophied lingual tonsils are still cauterized by some[4] but electrocoagulation[5] seems to be much superior. The technique is similar in both cases. The heaped-up tissue is painted with cocaine 10 per cent, and then the base of the tongue is injected with novocaine 1 per cent, with perhaps adrenaline. One side is usually done at a time and the other side a week or ten days later. The patient holds his own tongue between a piece of folded gauze, and the laryngeal

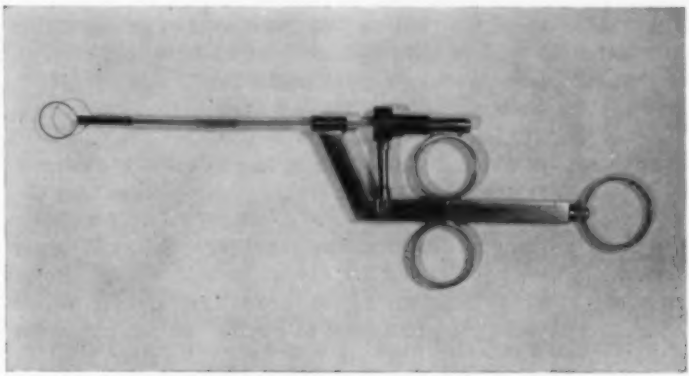

Fig. 2. Photograph shows snare. Barrel insulated with polyethylene tubing. The loop can be turned to any required angle. This instrument is very convenient when a snipping for biopsy is required.

mirror is held to see the area to be treated. If the cautery is used, three or four spots are touched with the hot point. A disadvantage of the cautery is the charring effect it has on the surface. This results in severe pain as healing takes place. When electrocoagulation is carried out the single or double needle is inserted into several prominent areas and the current switched on. Within a few days the treated nodules shrink, and as granulation occurs the heaped-up tissue becomes flattened and the symptoms disappear. It is surprising how little discomfort it causes the patient.

Some otolaryngologists are apprehensive about the hemorrhage in these cases. This fear is usually unwarranted. A method that has proved very satisfactory in the hands of the

writer is to use a loop half an inch in diameter connected to a diathermy unit, either unipolar or bipolar. (Two interchangeable rigid loops have been found useful, one a half inch and one a quarter inch in diameter. They fit into an insulated barrel of a snare handle which is connected by a cord with the diathermy unit. A foot switch controls the current). Under local anesthesia the excess tissue can easily be "shaved" off from within outward. Bleeding is negligible, as the vessels are sealed off in the process. As a rule the pain following this procedure is not severe. It is wiser to remove a little at a time than to be too radical. One can always go back at a later date and remove any hypertrophied nodules still present. The smaller loop is excellent for this.

X-ray and radiation therapy have been recommended to shrink this lymphoid tissue when it is moderately enlarged, but the results are questionable.

When the lingual tonsils are markedly enlarged their removal is best carried out by dissection and snare. Some surgeons consider this an office procedure, but it would seem safer to take the precaution of having the patient under supervision in the hospital. It can be done under local or general anesthesia, but as it is an advantage to have the patient sitting up with the head tilted slightly forward, local anesthesia is to be preferred. If the patient is nervous or upset a half reclining position on an operating table is satisfactory.

The same premedication is used as for tonsillectomy (Nembutal gr. III one-and-one-half hours before operation and morphine sulf. gr. $\frac{1}{4}$ and scopolamine 1/150 a half hour later.) The base of the tongue is swabbed with cocaine 10 per cent, and if there are tonsil tags present in the lower pole, they are painted as well. Novocaine 1 per cent with adrenaline is injected into the area and into the tonsil fossae.

The palatine tonsil tag, if present, is grasped and dissected free. The incision is then carried transversely across the tongue from the anterior pillar to the midline in the neigh-

borhood of the foramen caecum. This, of course, is just behind the apex formed by the circumvallate papillae.

The lingual tonsil is then held by a tenaculum and lifted up and separated from the capsule with a septal elevator or curved scissors. At times scissors are necessary, due to scarring and adhesions. To get a proper exposure it is an advantage to have an intern or nurse hold the tongue forward and out of the mouth as the dissection is carried back to the vallecula. When the whole lingual portion is elevated it is finally removed with a tonsil snare. The bleeding as a rule is not troublesome and can usually be controlled by pressure. Isolated vessels sometimes require a ligature. Any remaining heaped-up nodules, visualized in the laryngeal mirror, can be removed with a ring punch. The other side is then treated in the same way. It is a wise precaution to warn the patient that his throat will be sore for a week or ten days and his taste might be affected for a short time.

The sensation of a lump in the throat is a common complaint in nose and throat practice and most cases are considered by laryngologists to be functional in origin, unless something definite is found. The symptoms of hypertrophy of the lingual tonsils are so variable and at times indefinite, that many of these cases are overlooked; however, if this condition is kept in mind and the area at the base of the tongue examined routinely with the laryngeal mirror many borderline cases will be recognized. The treatment outlined above has proved satisfactory and most patients relieved of their symptoms.

The following history brings out a number of points which might be mentioned:

An adult, male, of 55 years, complained of a slight fullness on the left side of his throat, just above the "Adam's apple" of three or four months' duration. The symptoms were very indefinite, but at times the patient complained of a scratchiness. There was never any difficulty with food and no sign of blood. On examination with the laryngeal mirror the lingual tonsil on the left was hypertrophied extending to the epiglottis. Nothing else abnormal was found. Local painting with silver nitrate 10 per cent helped temporarily, but the symptoms recurred. A series of X-ray treatments were carried out, which also seemed to relieve the condition for a time; however, the result was not permanent. Finally under local anesthesia as described above, the

redundant lingual tissue on the left at the base of the tongue was removed with the diathermy loop (one-half inch in diameter).

This treatment was carried out two years ago, and since then the patient has had no further complaints concerning his throat.

A second case noted in the opening remarks turned out to be much more serious and prompted the writing of this article.

A man of 49 years complained of a slight soreness low down in his throat on the left side. He was in Europe at that time and an examination by a competent laryngologist (April, 1956) was negative. Shortly afterwards a gland appeared on the left side of the neck just behind the sternomastoid muscle. The gland became fluctuant and was drained and cultured. The predominant organism was Staph. aureus. In the meantime (three months later) the patient was in another city for business reasons and consulted a second laryngologist. From the history it was thought that the gland followed a palatine or lingual tonsillitis. The nose and throat examination was again negative, as well as a bronchoscopy. In view of this the patient was told that the gland would probably subside. Unfortunately, three or four months elapsed before he was re-examined. During this time a second gland was felt adjacent to the previous one and another was palpated on the right side behind the sternomastoid muscle. As the patient still complained of severe pain on swallowing, the base of the tongue was inspected with the laryngeal mirror and a crater-like ulcer the size of a ten-cent piece was seen just anterior to the epiglottis. The ulcer was situated more on the left side but also crossed the midline. It contained a greenish slough. The epiglottis and larynx were normal. A biopsy showed squamous celled carcinoma.

A number of consultants reviewed the case, and it was their considered opinion that with glandular involvement present, surgery offered little hope. The patient was, therefore, given heavy doses with the Cobalt bomb, and as many treatments as he could tolerate with safety. The ulcer has become more shallow, the glands have partially subsided and as a result the swallowing less painful; however, the long range prognosis is very poor.

One or two points might be stressed:

1. Carcinoma in this region often cannot be seen in the early stages.

2. Palpation with the gloved finger in the beginning, usually gives more information than the laryngeal mirror.

3. Unless recognized early and treated radically, the condition is hopeless, as the glands become involved early.

The reason for citing this case, of course, is the fact that for a long time no lesion was seen, and it was assumed that the glands were secondary to a lingual tonsillitis. As a result,

valuable time was lost and the correct diagnosis unnecessarily delayed.

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1390 Sherbrooke St. West.

FIFTY-FIFTH CONGRES FRANCAIS d'OTO-RHINO-LARYNGOLOGIE

The 55th Congres Francais d'oto-rhino-laryngologie will be held October 22-25, 1957, in the Grand Amphithéatre of the Faculté of Médecine of Paris, under the presidency of M. le Prof. Aubry de Paris, with honorary president M. le Prof. Léon Binet, membre de l'Institut, Doyen de la Faculté de Médecine de Paris. Numerous communications will be presented and two problems will be discussed:

1. Cancer of the Ear: Mm. J. Leroux-Robert et Ennuyer.

2. Tinnitus: Mm. A. Appaix et J. Bouche.

An exhibit of surgical instruments, apparatus and pharmaceutical specialties of interest to otorhinologists will be presented.

For further information address the administrative secretary, Cabinet Raimond, 17 rue de Buci, Paris.

UTILIZATION OF RHINOPLASTIC TECHNIQUE HEMI-LATERAL RHINOTOMY.

For the Removal of Intranasal Tumors.*†

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Cheyenne, Wyo.

Many surgical techniques have been advocated for the removal of tumors of the nasal cavities and the accessory sinuses. The purpose of this presentation is to suggest a modified technique (hemi-lateral rhinotomy), which in selected cases affords a more adequate exposure than the customary procedures. The application of rhinoplastic principles, basically a medial and lateral osteotomy, costs little in terms of cosmesis. The approach, which will be described, was first presented by Dr. M. H. Cottle.[1] He suggested a medial and a lateral osteotomy for exposure of the nasal chamber.

Bordley and Langmire[2] described a rhinotomy in which lateral osteotomies were made on both sides, and the nasal septum was severed, thus exposing both nasal apertures. This procedure offers an excellent exposure, but at the expense of disturbing the nasal septum.

Heatly[3] advised a lateral rhinotomy in exposing tumors of the maxillary sinuses. He used the classical Moure or Fergusson incision and removed the lateral wall of the nose when necessary to permit free access to, and inspection of the adjacent nasal cavity.

Schall[4] recommended a similar incision for lateral rhinotomy. He removed the ascending process of the superior

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maxilla and the nasal bone when necessary for adequate exposure of the tumor.

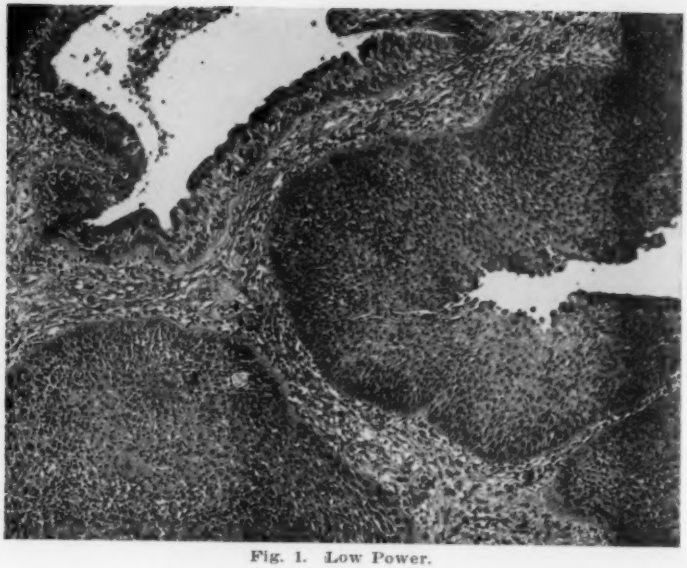
The surgical approach which Dr. Cottle suggested has proven beneficial recently in the removal of four unusual unilateral tumors of the nasal cavities. The technique is as follows:

Anaesthesia: May be local or general. One of the cases reported was performed under general anaesthesia (Sodium Pentothal with intubation). The last three cases were performed under local anaesthesia using cocaine flakes and adrenalin topically, intranasally, and 2 per cent xylocaine with epinephrine 1:100,000, injected subcutaneously. The infra-orbital and the palatine foramen were injected.

Preoperative Medications: Doriden 1 gm. two hours prior to surgery. Demerol 100 mg. and Thorazine 12½ mg. one hour prior to surgery.

Operative Procedure: The line of incision was marked with methylene blue beginning at the naso-frontal suture, 3 mm. medial to the inner canthus, extending inferiorly to and around the alar facial fold so as to complete an alar vestibular incision. The incision was made to the bone, thus incising the periosteum which was elevated laterally over the anterior wall of the maxillary sinus. The corresponding nasal bone was separated from the nasal septum 1 cm. superior or cephallic to the rhinion, intranasally with a 7 mm. chisel. The osteotomy was completed under direct vision by means of a saw, straight 4 mm. chisel and curved 5 mm. chisel, thus completely severing the nasal bone medially, laterally and superiorly in the region of the nasal frontal suture. The side of the nose was then retracted medially and held in place by means of a silk suture inserted in the footplate of the ala.

This exposed the nasal chamber. The lacrimal apparatus was easily dissected free by removing the thin layer of bone external to the lacrimal duct down to its entrance into the inferior meatus. In each instance the lacrimal duct was severed just before entering the nasal chamber and was cut on a bias. The bone was then removed over the face and



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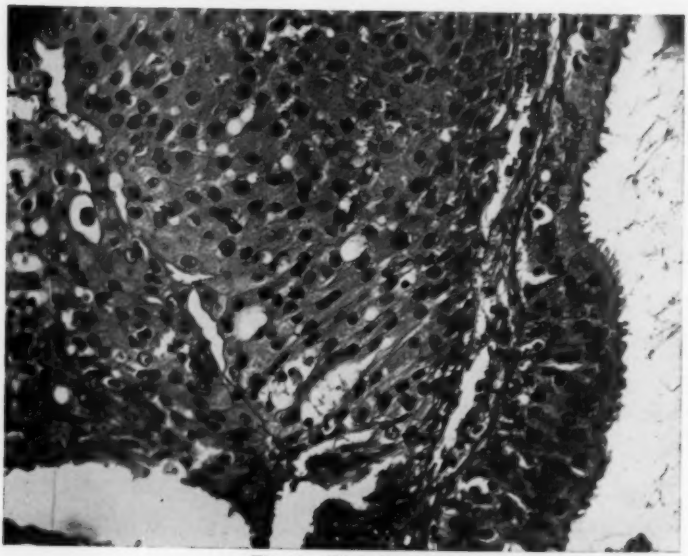

Fig. 1. High Power.

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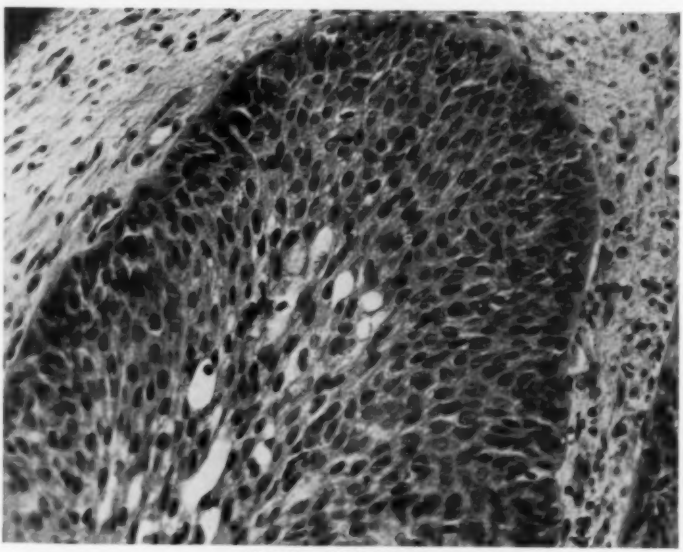


Fig. 1. High Power.

Case 1.—See description of microscopic examination in text.

apex of the maxillary sinus so as to expose completely the contents thereof. The lacrimal duct was then reflected more laterally, and the orbital contents were freed from the lateral wall of the ethmoid labyrinth, severing the anterior ethmoid vessels. Bleeding was easily controlled by adrenalin tampons. A 7 mm. chisel was then used to sever the bony attachments along the floor of the lateral wall of the nose or the medial wall of the maxillary sinus down to the region of the palatine foramen, avoiding the descending palatine vessels. A chisel was then inserted superiorly, immediately below the cribiform plate to sever the medial wall of the orbit or the ethmoid plate from its attachments superiorly to the face of the sphenoid. By reinserting a curved chisel it was possible to lift up the contents and separate the lateral wall of the nose from its posterior attachments carefully avoiding the transphenoidal vessels. If deemed advisable to remove the mucosa of the maxillary sinus it could be elevated and left attached to the middle meatal region and the entire contents of the maxillary sinus, many of the ethmoid cells, and the lateral wall of the nose could be removed *in toto*. Removal of the remaining ethmoid cells, inspection of the sphenoid sinuses was done with very little bleeding, because, by careful dissection, no major vessels were encountered. The lacrimal duct was sutured to the soft tissue of the orbit with 4-0 Chromic catgut. Following this, a small vaseline gauze dressing was applied to the raw surfaces. The lateral wall of the nasal pyramid was laid back into its original position, the periosteum and the subcutaneous tissues sutured in place by 4-0 Chromic catgut. The skin from the inner canthus down to the foot of the ala was approximated with interrupted silk sutures. From the alar facial fold to the vestibule interrupted 5-0 Dermalon sutures were used. Before approximating the floor of the vestibule medially, the ala was trimmed so as to reduce the size of the nostril on this side. Eye pads were applied to the eye, and a small tape dressing with moderate pressure to the orbit was applied. Stitches were removed on the third day. Patients were discharged from the hospital on the fourth postoperative day.

Case 1. Mr. C. K., age, 56. This patient complained of epistaxis on the left side and not being able to breathe through the right nostril for

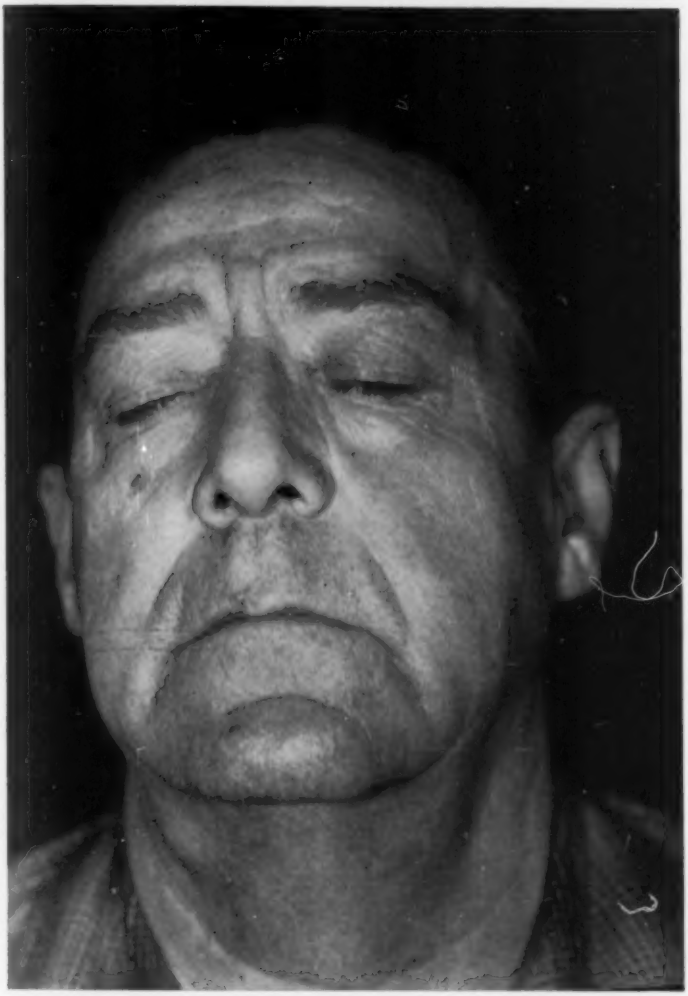
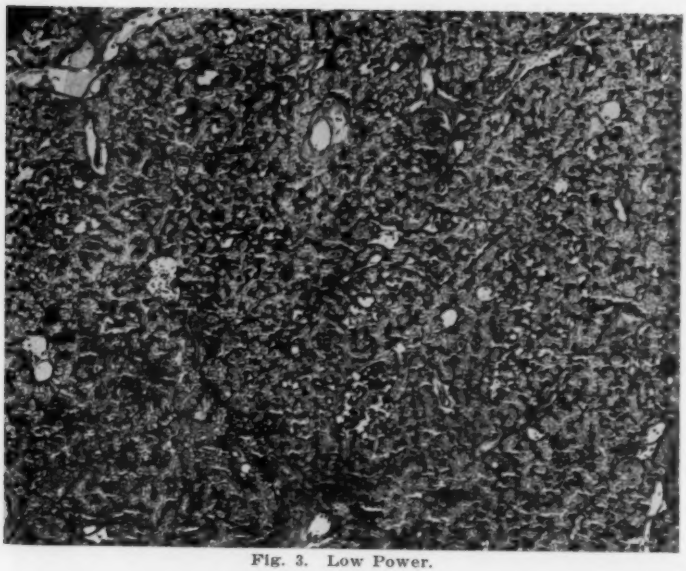


Fig. 2. C. K.—Post-operative eight months.



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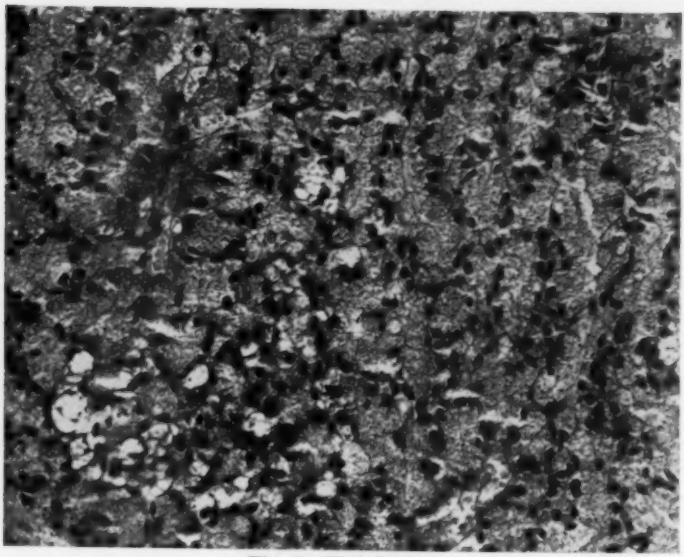
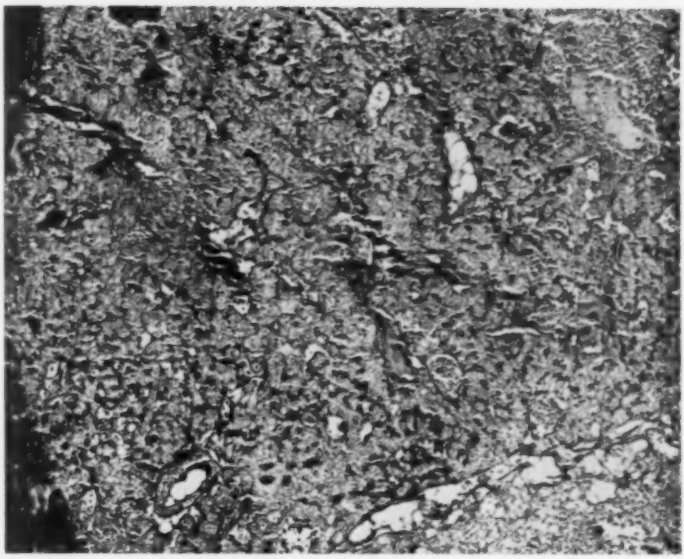


Fig. 3. High Power.



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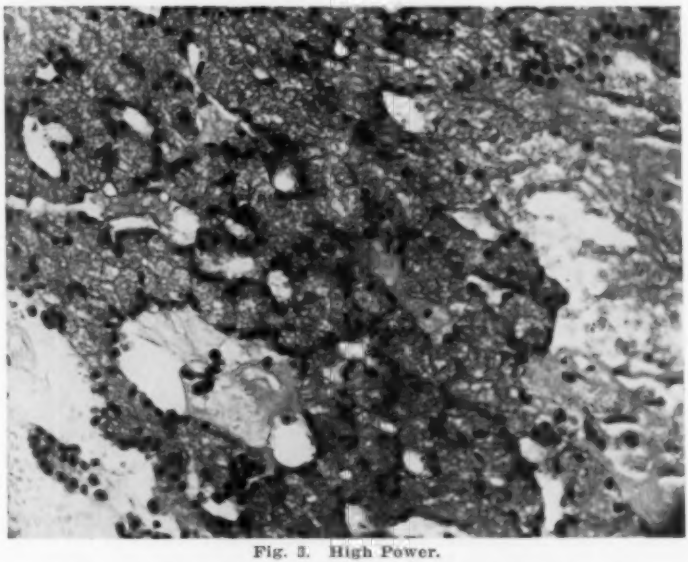


Fig. 3. High Power.

Case 2.—See description of microscopic examination in text.

a period of several months. A growth had been removed from the right side of his nose several years previously.

Examination revealed a mulberry-like mass extruding into the right nostril, which bled easily on the slightest manipulation. Nasopharyngeal examination revealed a similar mulberry-like mass completely blocking the right posterior nares. The left side of the nose had an anterior ulceration of the nasal septum which bled easily.

X-ray of the paranasal sinuses revealed a 4-plus density of the right maxillary sinus and a 3-plus density of the ethmoid cells and a 2-plus density of the sphenoid sinus on the left. The sinuses on the right side showed a 1-plus density.

Microscopic Examination.—"The tissue consisted of a central core of loose connective tissue containing dilated thin-walled blood channels and a few inflammatory cells. These stalks of tissue were covered by very thick layers of well differentiated stratified squamous epithelium. Some inflammatory cells are also present in the epithelium.—Drs. Zuckerman, Andresen and Tsumagari.

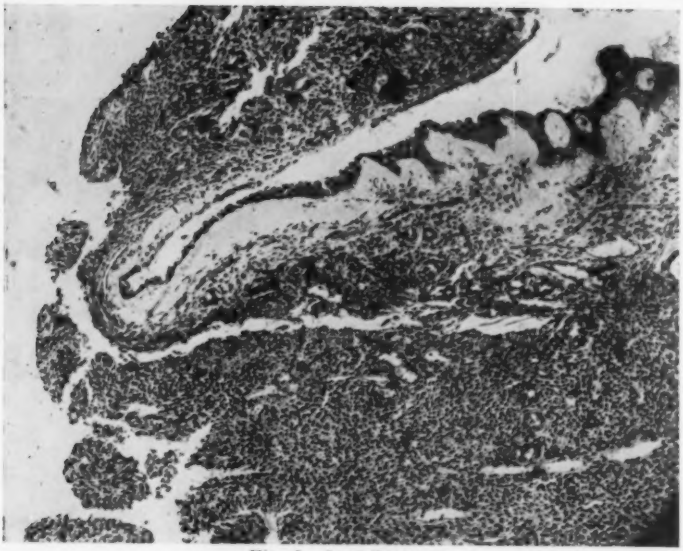
Anatomic Diagnosis.—"Epithelial polyp of the nose. There was no evidence of malignancy in this tissue; however, these tumors tend to become malignant after repeated local recurrence."—Drs. Zuckerman, Andresen and Tsumagari.

Clinically this tumor had the appearance of a malignancy, although repeated biopsies revealed no evidence thereof. This mass had been removed once before and its origin was undetermined. Since, in my opinion, there was a possibility of malignancy, the usual intranasal approach was inadequate to deal with this particular case; therefore, I elected to do a hemi-lateral rhinotomy. The tumor mass, including the lateral wall of the nose and the contents of the maxillary sinus, were removed *in toto*. The remaining ethmoid cells were exenterated, the sphenoid inspected. This operation was performed under sodium pentothal anesthesia with intubation. The patient had an uneventful recovery. The resulting deformity is shown in Fig. 2.

Case 2. Mrs. E. W., age 53. Mrs. W. complained of a stuffy nose on the right for the past six months, which was gradually becoming more intense with frequent epistaxis. She had no headaches and no weight loss. She attributed her epistaxis to be secondary to change of life, and was not too concerned about the inability to breathe through her nose. Since her episodes of bleeding were becoming more frequent and more severe she decided to seek medical advice.

Clinical examination revealed a large mulberry-like mass which presented itself in the right nostril and bled profusely on the slightest manipulation. The mass extended into the nasopharynx and had a smooth, reddish glistening appearance, completely filling the posterior nares. X-rays of paranasal sinuses revealed a 4-plus density of the right maxillary sinus and a 2-plus density of the ethmoid. An increased density of the sphenoid sinus on the right was also noticed. There

Fig. 4. Mrs. E. W.—Post-operative six weeks.



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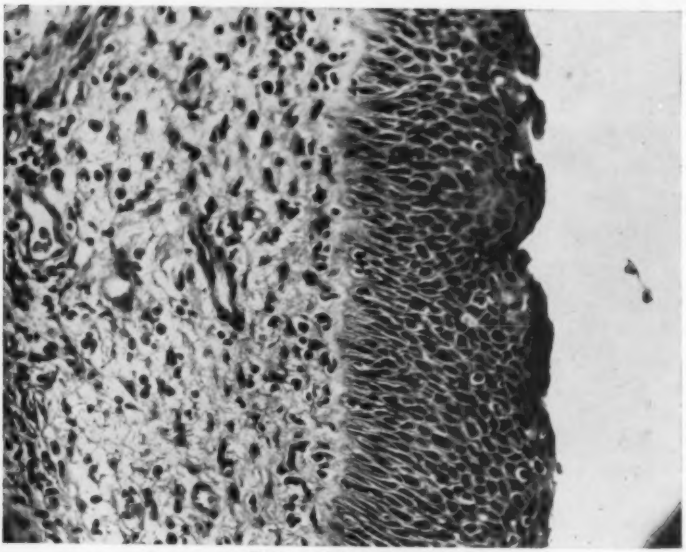

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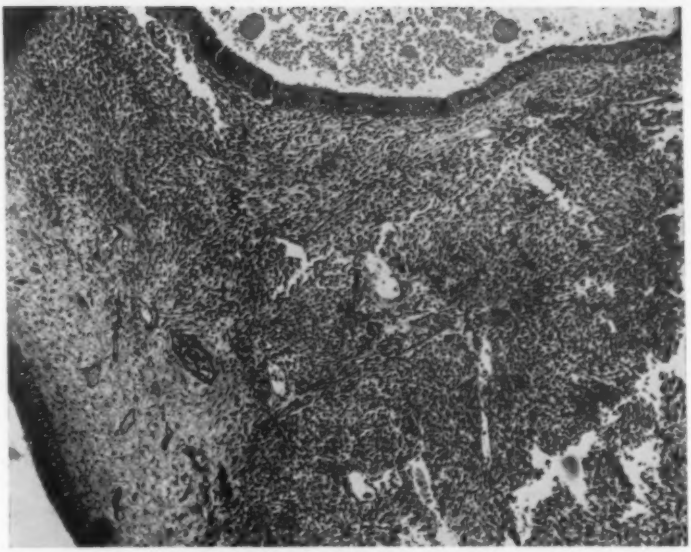

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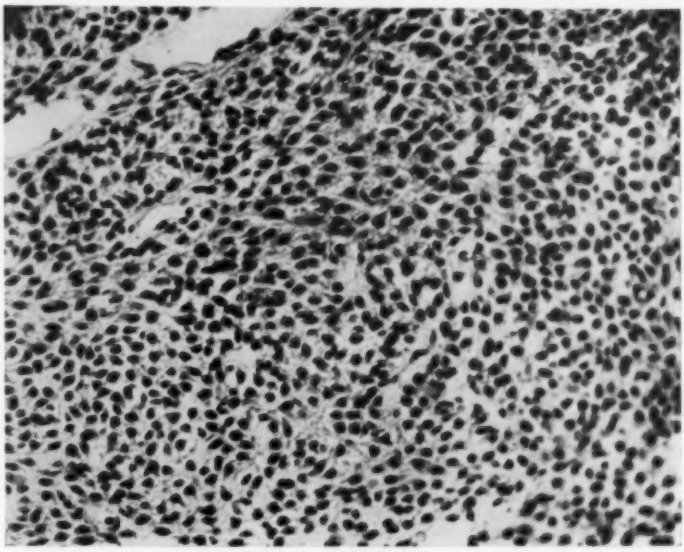


Fig. 5. High Power.

Case 3.—See description of microscopic examination in text.

was no evidence of bone destruction. The mass completely obstructed the posterior portion of the nose.

Microscopic Examination.—"Microsection through polypoid structures showed overlying epithelium of squamous type which ended abruptly. Most of the tumor was without lining and many large clusters of bacterial organisms were present. The bulk of the tumor consisted of closely packed orderly mucous glands which appeared in close approximation with little stroma. Calcification within the lesion was seen. Dilated vascular spaces were present at the margin of the mucous cells."—Drs. Zuckerman, Andresen and Tsumagari.

Anatomic Diagnosis.—"Mucous gland adenoma, nose." "Note: The tumor extends into the base of the lesion."—Drs. Zuckerman, Andresen and Tsumagari.

A right hemi-lateral rhinotomy was performed by the technique previously described. The patient made an uneventful recovery with only a moderate residual facial deformity as seen in Figure 4.

Case 3. Mr. H. H., age 70. This patient sought medical attention due to nasal obstruction on the left side of the nose, from three to six months' duration. No other complaints were elicited .

Examination revealed a rather large, reddish glistening mass, which presented itself over the anterior tip of the left middle turbinate. Nasopharyngeal examination revealed no evidence of a tumor. A biopsy was then taken with a nasal snare. The tumor mass seemed to offer little resistance to the snare, which cut almost like liver tissue. It bled profusely.

Microscopic Examination.—"One section of this tumor showed normal nasal epithelium which consisted of tall ciliated columnar epithelium with slight stratification of the nuclei. Beneath the underlying epithelium, well differentiated mucous glands were seen surrounded by dense connective tissue. In the stroma a large number of vascular spaces, which showed a bland, fibrous stoma consisting of collagen and adult fibroblasts.

The adjacent specimen showed a similar overlying nasal epithelium, however a loose stromal background showing vascular spaces were seen. There were fusiform cells running in intertwining cable-like fashion. Cytoplasmic extention from the nuclear boundary was seen; however, vacuolation of the intervening substance was noted. These vascular channels appeared open and were lined by endothelial cells. In a few areas radially arranged fusiform cells about the vessels were noted. In the tumor areas, there was hemorrhage into the stroma. One area was noted with large collections of neutrophils, debris, and red cells. In several areas a very loose stromal background was noted in which stellate cells were present with myxomatous changes."—Drs. Zuckerman, Andresen and Tsumagari.

Anatomic Diagnosis.—"Cellular angio-fibroma, nose." "Note: This tumor contains areas of myxomatous degeneration which is a common change in tumors of the nose."—Drs. Zuckerman, Andresen and Tsumagari.

The technique as described was used removing the mucosa of the maxillary sinus and the lateral wall of the nose in one mass; however, much to my surprise the tumor was still present and was found to be attached to the most cephallic portion of the nasal septum immediately below the cribriform plate by a rather wide pedicle. Before excision of the mass, which seemed to arise from the mucosa of the left side of the septum, a perforation the size of the attachment of the tumor was noted

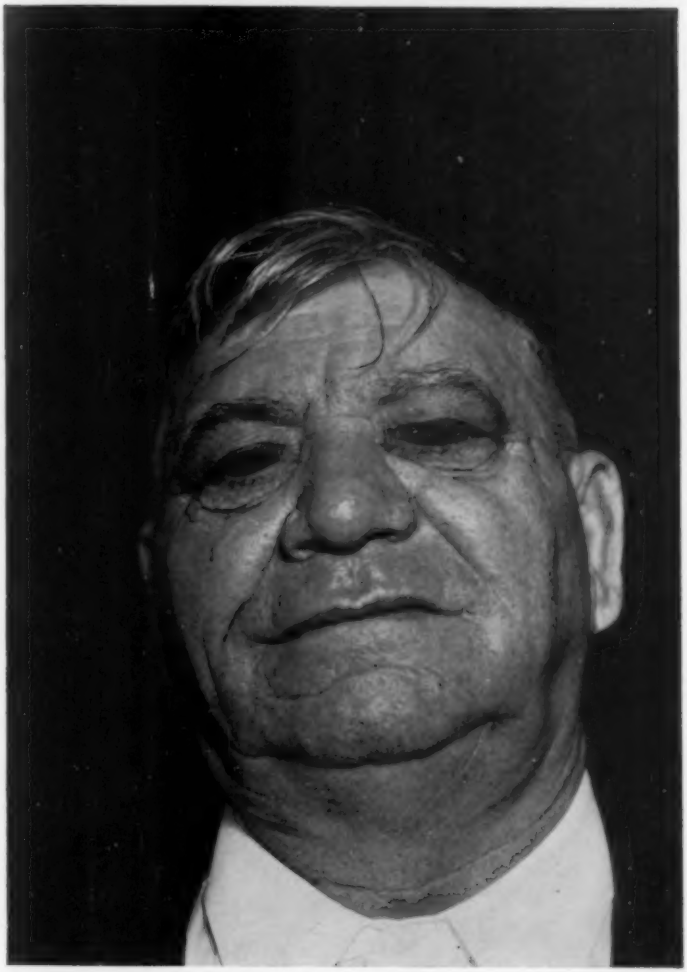
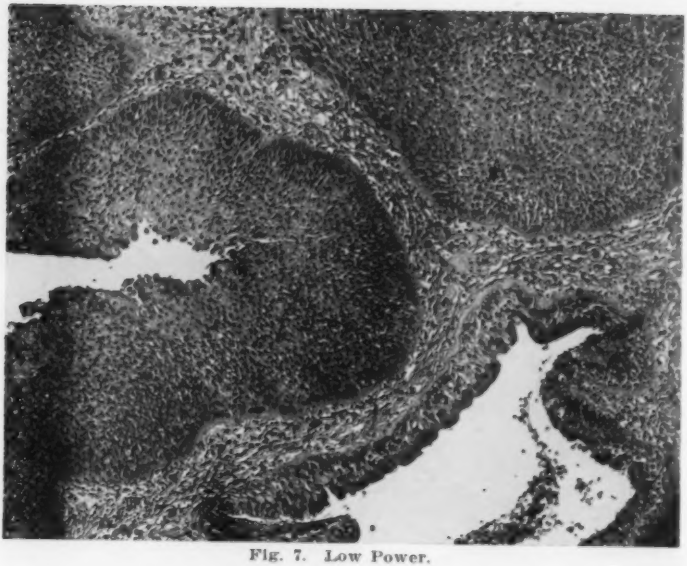


Fig. 6. Mr. H. H.—Post-operative six weeks.



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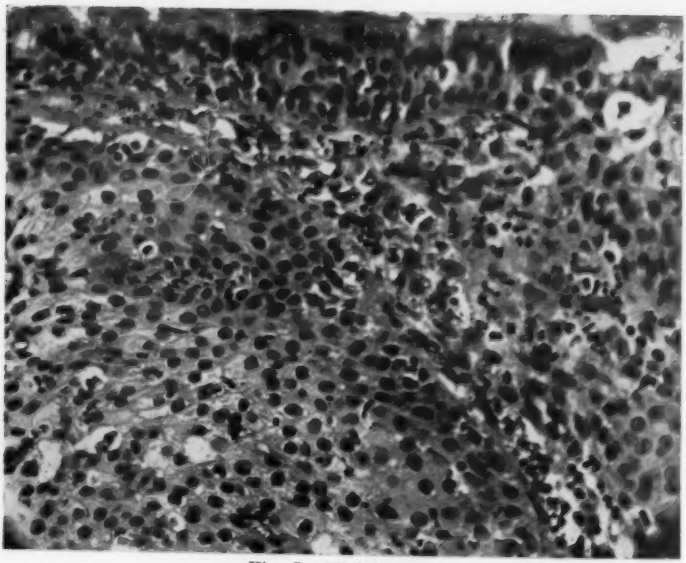

Fig. 7. High Power.

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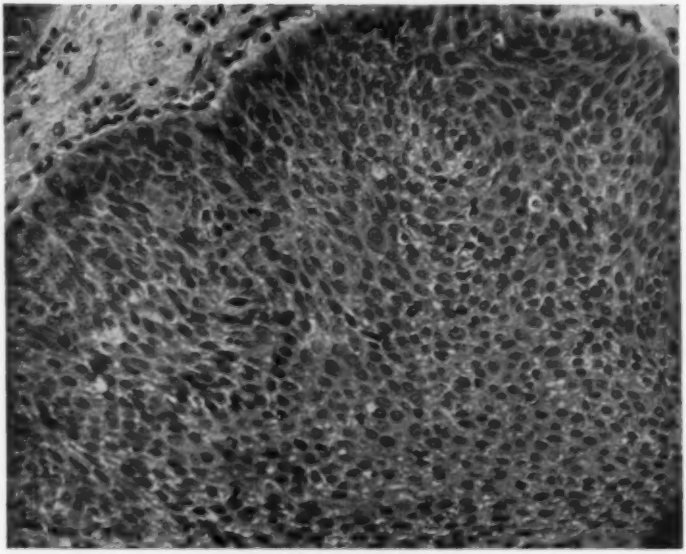

Fig. 7. High Power.

Case 4.—See description of microscopic examination in text.

in the bony septum. In this case one could possibly have spared the lateral wall of the nose, but even with this exposure one could not be sure of the exact origin of the tumor. Since the mucosa of the maxillary sinus was definitely diseased, I felt justified in removing it. The patient made an uneventful recovery.

Fig. 6. Post-operative picture is self explanatory.

Case 4. Mrs. E. N., age 50. This patient complained of nasal obstruction of the left side of the nose, of several months' duration. Polyps had been removed repeatedly with very little improvement. Clinical examination revealed a large nasal cavity. It was not easily determined whether any of the turbinate structures had been previously removed. The posterior half of the nasal cavity was filled with a large fungating mass which completely filled the cavity. On nasopharyngeal examination visualization was difficult with a mirror, but a glistening mass could be seen by merely elevating the soft palate. It was assumed that it completely filled the nasopharynx and obstructed the posterior nares on this side. X-ray revealed the maxillary sinuses, ethmoid cells and sphenoids to be cloudy. There was no evidence of bone destruction. A hemi-lateral rhinotomy was performed. When the mass was delivered a sound similar to that of opening a wine bottle was elicited as the mass came through the posterior nasal fossae.

Microscopic Examination.—"Microsection through polyp showed a hard fibrous stroma with a profuse infiltration of inflammatory cells of acute and chronic type. Foci of lymphocytes were present, surrounded by a diffuse infiltration of neutrophils. The lining epithelium of transitional type showed a distinct metaplasia into flattened squamous cells with distinct intercellular bridge formation of the squamous type. These appeared as large wide clusters showing extensive acanthosis. The prolongation of the metaplastic epithelium showed remnants of its original cell type."—Drs. Zuckerman, Andresen and Tsumagari.

Anatomic Diagnosis.—"Nasal epithelial polyp or 'papilloma'." "Note: Although this lesion is not malignant, recurrence of such tumors is not unusual and transition into neoplasm is a distinct possibility. The process that apparently occurred in this polyp is a metaplasia from transitional epithelium to adult differentiated squamous type; the metaplastic epithelium forming the acanthotic areas."—Drs. Zuckerman, Andresen and Tsumagari.

CONCLUSIONS.

No original claims are made for rhinotomy, as it has been performed for centuries; however, the hemi-lateral rhinotomy, with the described modifications, is not found in the literature. As was mentioned previously, this approach was first described and presented by Dr. M. H. Cottle.

I realize that some disturbances in the physiology of the nasal structures might ensue; however, in my opinion the benefits outweigh the disadvantages which may result from this procedure.

This surgical approach is indicated in carefully selected

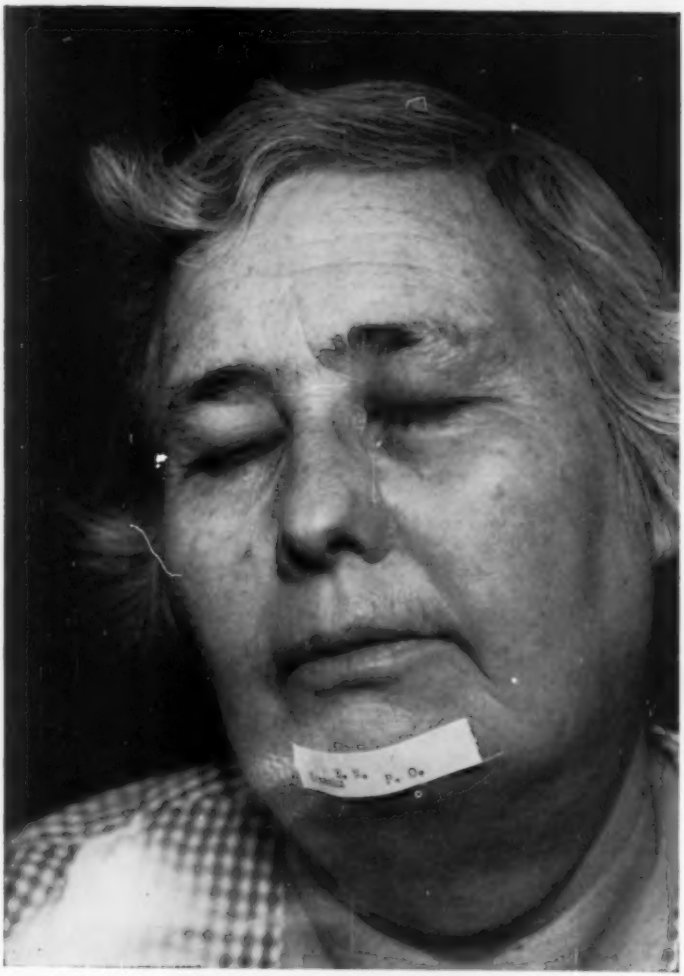

Fig. 8. Mrs. E. N.—Post-operative six weeks.

cases where the customary procedures would not give adequate exposure for satisfactory removal of the tumor.

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408 Hynds Building.

INSTITUTO MEXICANO DE LA AUDICION Y EL LENGUAJE.

The Mexican Institute of Hearing and Speech will offer an inter-American training course in Spanish for teachers of the deaf February 1 to December 31, 1958. Registration for the 1958 course closes October 31, 1957. This course will be held annually and will be under the auspices of Dr. S. Richard Silverman of Central Institute for the Deaf, St. Louis, Mo.

For further information write Professor Dr. Pedro Berruecos Tellez, 141-a Progress Street, Mexico 18, D.F.

SCHWANNOMA OF THE PHARYNX WITH HORNER'S SYNDROME.

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and

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Schwannoma of the pharynx, first reported in America by Figi in 1933,[1] is relatively rare. Guggenheim,[2] after a careful search in 1953, could collect only 34 cases, and since that time as least five additional cases have been reported.[3,4,5,6,7,8] The case being reported is the third from the Los Angeles area,[9,10] and the forty-first in the total literature.

This tumor arises from the nerve sheath cells (sheath of Schwann), and its position and relationship have been ably discussed and summarized by Stout.[11] It has been given many names, including neuroma, neurinoma, solitary neurofibroma, peripheral glioma and preferably, neurilemoma.

The presence of a Schwannoma in the neck is explained by the presence of the large number of peripheral nerves grouped in this area; however, this tumor has been reported in many parts of the body. In the head and neck it has been found in the eye, maxillary sinus, hard palate, larynx and salivary glands, as well as the VIIIth nerve (acoustic neuroma).[12,13,14,15]

Schwannoma of the pharynx has appeared equally in both sexes, in ages ranging from 20 years to 61 years. There is no known factor associated with their occurrence.

Numerous nerves in the neck could serve as the point of

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origin of a pharyngeal schwannoma, including the sympathetics, the vagus and the branches of the various cranial nerves. Attachment to the vagus has produced hoarseness with paralysis of the ipsilateral vocal cord. Involvement of the cervical sympathetic fibers has resulted in Horner's syndrome.

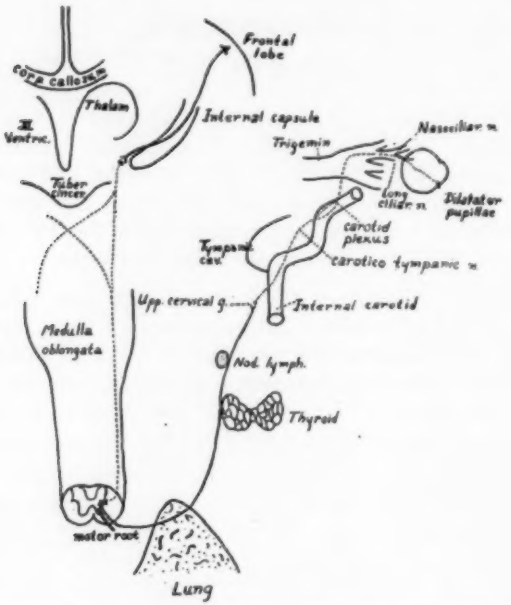

Fig. 1. Diagramatic description of nerve fiber pathways involved in Horner's syndrome.

The presence of Horner's syndrome has been reported in 13 cases. In three cases the syndrome was present before surgical treatment, and was aggravated by surgery. In the balance the Horner's syndrome was transient.

The tumor is commonly closely associated with the cervical sympathetic chain, fibers and superior ganglion. A nerve pathway extends from the brain stem to the eye by way of

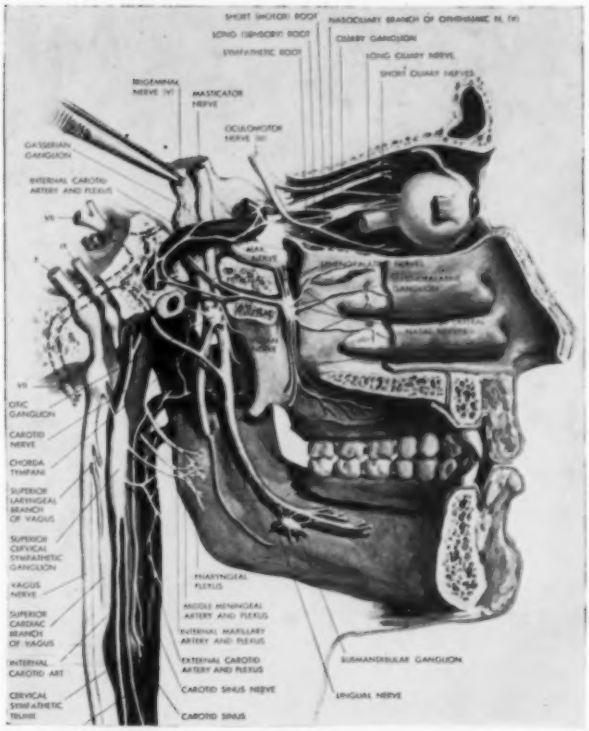

Fig. 2. (from Netter).* Showing the relation of the superior cervical ganglion to adjacent structures.

(*From the CIBA Collection of Medical Illustrations by Frank H. Netter, M.D., Copyright CIBA Pharmaceutical Products Inc.)

the cervical sympathetics, which is well known. Fibers leave the spinal cord through the first and second thoracic nerves, passing to the inferior sympathetic ganglion, then upward to the superior cervical ganglion. This ganglion rests upon the longus capitus muscle and is behind and medial to the internal carotid artery at the level of the second and third cervical vertebrae, in close relation with the pharyngeal mucosa. Enlargement of a tumor mass in this region, pressing against the unyielding lateral and posterior structures, bulges into the pharynx. A lesion involving the vertical

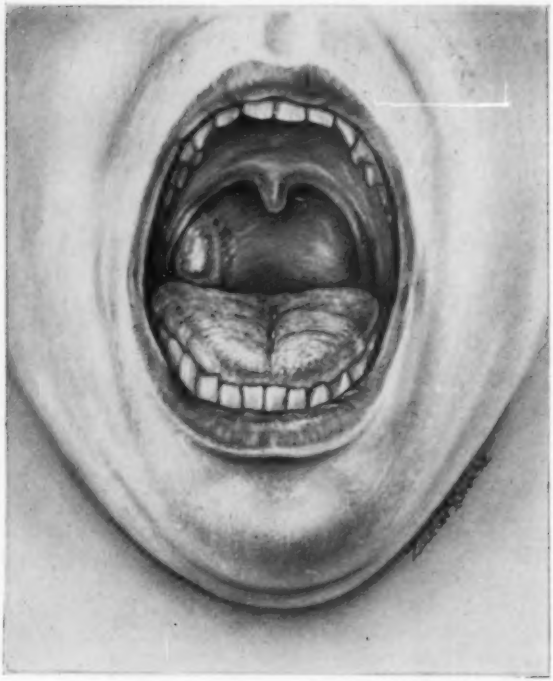

Fig. 3. (Case R.G.). Tumor in the right oral-pharynx.

sympathetic chain and fibers at this level can produce Horner's syndrome with enophthalmos, contracted pupil (miosis) and ptosis of the upper lid. There may be associated diminished sweating over the area involved.

Schwannomas have certain characteristics which are interesting but not diagnostic. They are slow growing benign tumors, painless even though of neurogenic origin, single and circumscribed. Should the tumor grow large in size it may produce symptoms of a space consuming lesion with dysphagia and symptoms of dyspnea.

The treatment of choice is surgical removal. The decision whether to use an intra-oral or an external approach should

Fig. 4. Schwannoma of superior cervical ganglion, general microscopic pattern, x 100. The central region of the photograph exhibits palisading, and Antoni type II loose tissue is seen in the corners. Thin connective tissue capsule.

be left to the judgment of the surgeon. Unless the lesion is extremely large and presents problems, the intra-oral approach is the one of choice. It is deemed wise to remove these tumors when seen. The rate of growth, even though slow, may create problems and complications if left *in situ*, from size alone, as shown by the case presented by Guggenheim.[2]

Since these tumors are benign, and radio-resistant, X-ray irradiation is not advisable.

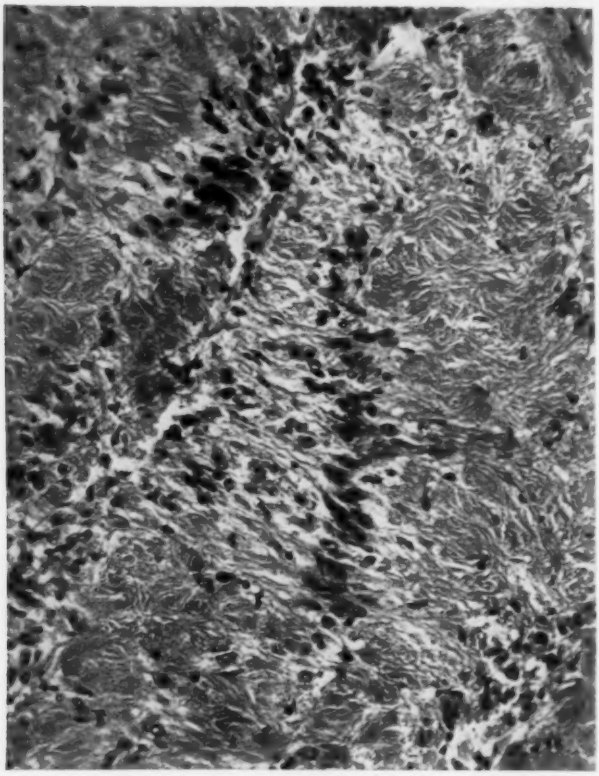

Fig. 5. Schwannoma of superior cervical ganglion, cellular detail x 400. This pattern occurs throughout the tumor.

The prognosis is very satisfactory, since this is a benign lesion. The complications following surgery as a permanent Horner's syndrome or ipsilateral vocal cord paralysis are surgical risks, which could appear even without surgery. Surgery need not be deferred unless the patient's general health or increased age are deterring factors.

CASE HISTORY.

R. G., male, 44 years of age, in apparent good health, complained of fullness and irritation of the right side of his throat for eight months.

There was no dysphagia. He had a tonsillectomy and adenoidectomy at eight years of age. Examination presented a mass of tissue which appeared to be underlying the mucous membrane of the right pharyngeal wall, apparently 2.5x1 cm. just posterior to the right tonsil fossa.

Surgery was done on Nov. 7, 1955. The tumor was excised under sodium pentathol and local anesthesia. The tumor presented a firm, well encapsulated growth approximately twice the size noted upon initial examination. It shelled out with the minimal amount of bleeding. Upon recovery from the anesthetic the patient complained of discomfort in his right eye, and the diagnosis of Horner's syndrome was made.

Gross Specimen. A tumor from the pharyngeal wall consists of an ovid structure, 43x33x22 mm. The surface is apparently completely surrounded by a fibrous capsule to which a few fibrous tags are adherent. The interior is composed of somewhat glistening, tan tissue which bulges slightly and is elastic. A few darker red-gray, more hemorrhagic areas, and punctate, white-streaked areas, are seen on the cut surface.

Microscopic Structure. This tumor is composed of elongated fibrous elements with a varied configuration. In many regions groups and rows of nuclei are associated with fusiform bundles of collagenous fibrils. These groupings of palisaded cells form intertwined striated zones and areas (Verocay bodies), in between which there is a loose edematous fibrillar tissue (Antoni Type II) containing numerous small blood vessels. In larger vascular sinusoids there are segments of thrombosis with organization. Medium sized blood vessels and sinusoids tend to occur in clusters throughout the tumor. The tumor has a fibrous capsule. Over one segment of the tumor the capsule incorporates a nerve trunk and a ganglionic mass, including typical large neurocytes.

Diagnosis: Schwannoma (neurilemoma) of parapharyngeal tissue. This tumor sprang from fibers in or near the superior cervical sympathetic ganglion, and included this structure intimately in its capsule. The ganglion was found microscopically only by fortuitous sectioning of the tumor mass. Its presence in the tumor explains the inevitable and inescapable occurrence of the Horner's syndrome.

The Horner's syndrome has persisted to date, although the symptoms are less prominent than immediately following surgical removal. Vision has not been impaired, remaining 20/20 in both eyes.

From the experience in this case, and considering the frequency with which Horner's syndrome has complicated other such cases, it would be reasonable to anticipate this occurrence or complication with any firm, elastic, submucosal tumor that bulges the pharyngeal wall just posterior to the faucial tonsil. Before operative removal of such a tumor, the patient could be warned accordingly.

SUMMARY.

1. A case (the forty-first) of Schwannoma of the pharynx is reported.

2. Horner's syndrome occurred as a postoperative complication.

3. The mechanism and the mode of development of Horner's syndrome in this case are discussed.

4. The possibility of occurrence of Horner's syndrome upon extirpation of such a tumor can be anticipated.

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